OCR
RECOGNISING ACHIEVEMENT

GCSE

Design & Technology (Systems & Control)

General Certificate of Secondary Education **GCSE 1957**

Combined Mark Schemes And Report on the Components

June 2005

1957/MS/R/05

Oxford Cambridge and RSA Examinations

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General Certificate of Secondary Education

GCSE Design and Technology: Systems and Control (1957)

MARK SCHEMES FOR THE UNITS

REPORT ON THE UNITS

Mark Scheme 1957/01
June 2005

1	(a)		Wood, pine, beech, ash, plywood (any 1) paint, chrome, zinc, plastic coat dip coat (any 1)	[1] [1]	
	(b)	(i)	Dowel	[1]	
		(ii)	greater accuracy, more consistency, [same place/size or 'all the same'] saves time, [allow quicker/faster], improves quality [any two]	[2]	
	(c)		sketch of correct joining concept e.g. screws/ bracket/ nut and bolt [must be secured to prevent pivoting e.g. do not allow only one screw]	[1]	
			correct naming of component	[1]	
	(d)	(i)	Vacuum forming/ injection moulding	[1]	
		(ii)	smaller package to take home/ have carried [qualified] lower cost [qualified] easier to move/carry easier to move at a later date [qualified] date easier to handle [qualified] reduced storage problems [qualified] less risk of damage in transit [qualified]	[any two]	
				[2]	[10]
2	(a)		no painting/ more rapid production/ lighter weight to transport [no cost related answers]	[1]	
	(b)		input - processing – wheel[s]/axle/gear not 'control', not 'movement'	[3]	
	(c)		anticlockwise – clockwise	[2]	
	(d)		Concept correct e.g. bush drawn (or increase thickness of plastic max 1) (or plate added e.g. pop riveted plate max 1) quality of communication [regardless] Written notes of explanation [regardless]	[2] [1] [1]	
					[10]

3 (a) must be waterproof
must have an on/off switch
must attach to the bicycle **[2]**
must have no sharp edges/corners
reference to light/beam
reference to safety laws
easy to change batteries
adjustable clamping
shock resistant
(any two)

(b) chemical – electrical **[2]**
electrical – heat [any one]
not 'potential'

(c) (i) A = capacitor **[1]**
B = L.E.D **[1]**

(ii) protects the LED/ stops it blowing **[1]**
prevents too high a current **[1]**
don't allow 'slows the current'
allow 'controls the current'
allow 'lowers the P.D. across the L.E.D

(d) surfaces not clean, components not tinned, soldering iron not hot enough, too little solder,
[allow a dry joint/ solder bridge] **[1]**

don't allow P.C.B. production related answers e.g. holes/ tracks etc.

[any one]

(e) avoid breathing the fumes, use fume extraction, do not touch heated parts, beware of spitting solder, use a soldering stand, eye protection, **[1]**
(any one)

[10]

4 **(a)** Able to draw + redraw rapidly
Able to test the efficiency of the design
Able to manipulate/rotate
3-D drawing or modelling/'check it works'
Export via email/electronic communication
Auto-dimensioning (Any 2) **[2]**

(b) **(i)** Lathe or **4 axis** milling machine **[1]**

(ii) High cost of set up, high capital cost, high cost of time to set up, more cost effective **[1]**

(c) Any reference to testing/inspection/tolerance

reference to any two dimensions = 1+1

e.g. measure length =1 **[2]**

(d) Careful storage/safety unit/air respirators/training courses for operators
mask, goggles, overalls,
(Any 2) **[2]**

(e) Heat pollution/chemical pollution/reduction of oil for other users (Any 2) **[2]**
greenhouse effect, CO2 production, Acid rain

[10]

5 **(a)** Temperature
Pressure/ tyre is flat/ puncture
Tread depth/tyre wear
Grip

\+ relate advantage related [allow stops you having a crash 1 max] **[4]**

(b) Sketch shows improved design idea (1)
Sketch is of good quality (1)

Notes explaining the method of ***securing*** in technical way (1)
Notes explaining why this is an improvement in ***security*** (1)

e.g. '***specialised*** tool must be used' = 2 **[4]**

(c) No/little stock is kept (1)
Less space in storage of parts (1)
Lower waste [must be qualified] (1)
Lower ***capital*** costs (1)
Design changes can be rapid this can prevent wasted stock (1) **[2]**

[10]

Mark Scheme 1957/02
June 2005

1 **(a)** Able to draw + redraw rapidly
Able to test the efficiency of the design
Able to manipulate/rotate
3-D drawing or modelling/'check it works'
Export via email/electronic communication
Also auto-dimensioning (Any 2) **[2]**

(b) **(i)** Lathe, **4 axis** milling machine

(ii) High cost of set up, high capital cost, high cost of time to set up, more cost effective **[2]**

(c) Any reference to testing/inspection/tolerance

reference to any two dimensions = 1+1

e.g. measure length =1

[2]

(d) Careful storage/safety unit/air respirators/training courses for operators mask, goggles, overalls,
(Any 2) **[2]**

(e) Heat pollution/chemical pollution/reduction of oil for other users (Any 2) **[2]**
greenhouse effect, CO_2 production, Acid rain

[10]

2 **(a)** Temperature
Pressure/ tyre is flat/ puncture
Tread depth/tyre wear
Grip

\+ relate advantage related [allow stops you having a crash 1 max] **[4]**

(b) Sketch shows improved design idea (1)
Sketch is of good quality (1)

Notes explain the method of securing in technical way (1)

Notes explain why this is an improvement in security (1)

e.g. '***specialised*** tool must be used' = 2 **[4]**

(c) No/little stock is kept (1)
Less space in storage of parts (1)
Lower waste [must be qualified] (1)
Lower **capita**l costs (1)
Design changes can be rapid this can prevent wasted stock (1) **[2]**

[10]

3 **(a)** **(i)** Suitable joint = rebate/dowel/dove tail/comb/ finger/ mitre (1)
Good quality sketch (1) **[2]**

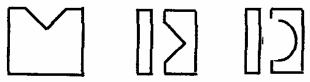
(ii) Correct name stated (1) **[1]**

(b) Cut from foam, RIM, accept Blow Moulding **[1]**

(c) Greater **consistency** in drilling/greater **accuracy**, saves time in setting up/no measuring needed [answer must be qualified] (1) **[1]**

(d) 2 locations given (end and side) (2)

examples of side location are shown below



Clamping of *round tube* considered (1)

Guiding of the drill considered (1)

Quality communication (1) **[5]**

[10]

4 **(a)** output:input
=120:20
=6:1 **(set out of work)** (1)
30/6=5 turns (correct calculated answer) (1) **[2]**

(b) Oscillating (1) to reciprocating (1) **[2]**

(c) Consistency in the shape produced (all identical)
Allows a complex 3-D shape to be formed (various thickness) (Any 2) **[2]**

(d) Repetitive flow **[1]**

(e) Diamond decision box added (1)

yes/Y and **no/N** added to box *with* feedback (2) **[3]**

[10]

5 (a) Aluminium is less rigid than steel so the tube is larger diameter (1)
BUT
It still gives a weight advantage/is lighter (1)
Reduced corrosion

Do **not allow** answers relating to **costing**

[2]

(b)

Sketch showing		***Note explaining***	
Secure attachment e.g. separate slotted fitting/clip	(1)	Secure attachment	(1)
Switch accessible e.g. no parts in the way	(1)	Switch accessible	(1)
Quick release e.g. wingnut/ push fit/ cam lever	(1)	Quick release	(1)
High quality sketch	(1)		

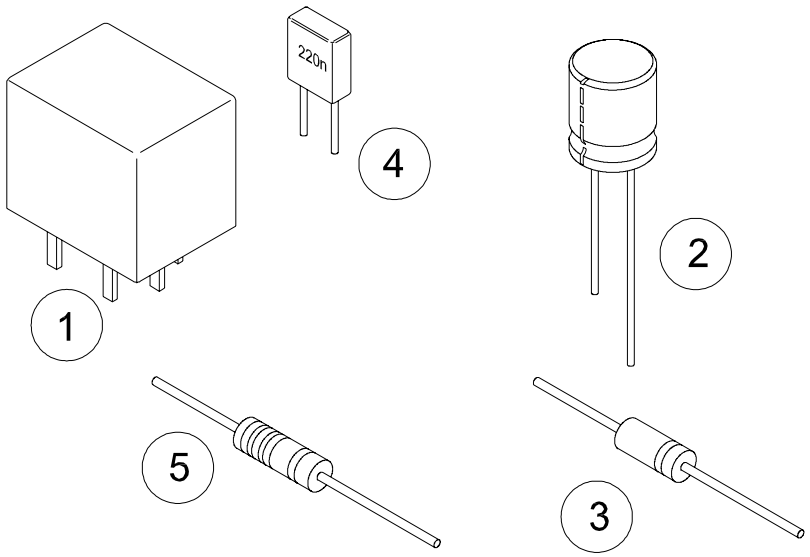
Reference to SUITABLE MATERIAL (1) **[8]**

[10]

TOTAL: [50]

Mark Scheme 1957/03
June 2005

(a) 1 mark for each correct (**1 5 4 3** 2 left to right) **[4]**



(b) **(i)** Colour bands indicate **value of the resistor** 1 mark, accept 47 or three zeros **[1]**

tolerance 1 mark.

accept 1% or 5% . **[1]**

(ii) The tolerance is lower on resistor **X**, therefore actual value will be closer to stated value, 1 mark for understanding shown. **[1]**

(c) The shorter leg indicates **cathode** or **negative** showing which way to insert it in the circuit, 1 mark for understanding of need to know polarity. **[1]**

(d) Resistor value **1M**, 1 mark, capacitor value **100µF**, 1 mark. **[2]**

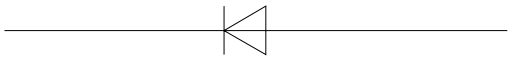
Total [10]

2 (a) (i) **2 input OR** gate, 1 mark **[1]**

(ii) The component to be replaced is resistor **R1** **[1]**

(b) The correct reading is 1 . 1 mark **[1]**

(c) (i) Diode symbol correct 1 mark, orientation correct 1 mark.



Accept pictorial view with correct placing of band. **[2]**

(ii) Diode prevents reverse flow of current if the battery is wrongly connected.
1 mark, allow suitable reason which shows understanding. **[1]**

(d) Mention of the **switching voltage** 1 mark,
reference to the **darlington pair** 1 mark. **[2]**

(e) Advantages could include:

- even illumination;
- light available in smaller space than lamp could fit;
- lower cost for lamps and holders, only one bulb to replace.

1 mark for a suitable advantage.

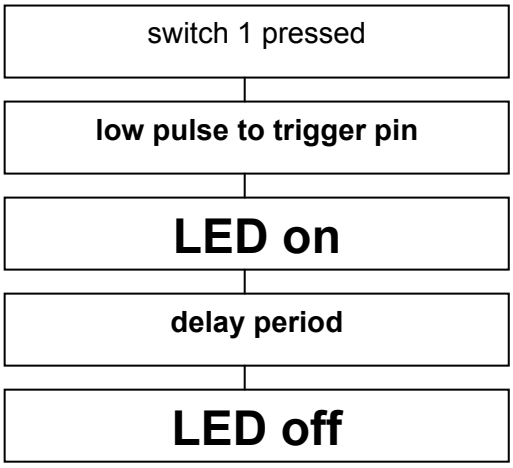
Disadvantages could include:

- cost of light transmitting rod compared to bulb and holder;
- no light at all if single bulb fails;
- lower overall level of light.

1 mark for suitable disadvantage. **[2]**

Total [10]

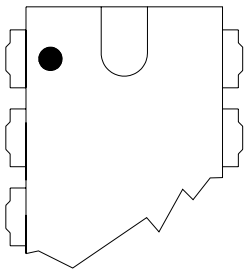
3 (a) (i) All stages correct 3 marks.
2 stages in correct position 2 marks.
1 stage in correct position 1 mark. **[3]**



(ii) Reset occurs, 1 mark. Allow mark for mention of timing period finishing or for understanding of the action of reset pin. **[1]**

(b) (i) Order code **02-145**, 1 mark. Allow mark if the socket is fully identified with description, i.e. *8 pin flat pin socket*. No mark for *8 pin socket.* **[1]**

(ii) 1 mark for either of recognised methods as shown. **[1]**



(c) (i) Fault X is a **solder bridge** between two pads, 1 mark. **[1]**
Fault Y is a **dry joint**, solder connected to the IC pin but not to the pad, 1 mark. **[1]**
Accept responses with understanding shown.

(ii) Description of the repair process:-
Fault X – wiping solder off with the iron, desoldering tool or solder wick,
1 mark for suitable method described, allow use of knife to scrape.
Fault Y – reheat with soldering iron making sure that both track and pad are hot, apply more solder, if needed, 1 mark. **[2]**

Total [10]

4 (a) (i) Advantage could include:
- all of model can be seen using rotation;
- easier to explain to client or other third party;
- can be used for export to machining file;
- realistic rendering possible;
  calculations based on mass or volume easier to carry out.

1 mark for a suitable advantage. **[1]**

(ii) Thickness of the material to be moulded, 1 mark.
accept sheet thickness 1mm – 3mm. **[1]**

(iii) Changes needed :
- clear indication of taper or draft to be added to all sides;
- rounded corners/edges.
- method of producing keypad raised area.

1 mark for each, response can be either written or drawn or a combination. **[2]**

(b) (i) Items that will be stored on a file include:
- size of board;
- pad size;
- pad shape;
- pad spacing;
- track position;
- track width;
- hole position;
- component position.

1 mark for each suitable feature. **[2]**

(ii) Screen layer will assist in assembly by indicating:
component position, component orientation, component value,
1 mark for each for mention of two features of the layer that will assist in controlling the quality of the assembled board. **[2]**

(c) Methods could include:
- using a limited range of plastics;
- marking each material clearly to show the type of material used;
- designing the product to break down easily into recyclable parts;
- using components/parts that are easily removable.
- use of recycling symbol;
- use materials that can be recycled.

1 mark each for two methods. **[2]**

Total [10]

5 **(a)** Areas could include:
large numerals, sloping front for easy reading, easy access of buttons, sound directed upwards, 1 mark for each relevant area, max. 2 **[2]**

(b) **(i)** Electric shock warning, CE mark or double insulation symbol. 1 mark **[1]**

(ii) The battery is used for back –up in cases of mains failure.
It will retain the time/alarm settings, 1 mark for relevant reason. **[1]**

(c) Slide switch will retain the setting (bistable action), allowing the waveband setting to be retained, allow indicates whether set to AM or FM, 1 mark.
Press switch is momentary as minute / hour setting will require only single pulses before release, (monostable action), 1 mark **[2]**

(d) **(i)** Clear drawing and/or description 1 mark, effective method used, 1 mark. **[2]**

(ii) The device will be moved and possibly subject to vibration in transit, the glue ensures that fragile components will not move under vibration, allow – settings on presets and variable components are not lost, economical method of fixing when repair is not likely. 1 mark for identifying reason, 1 mark for identifying likely result of not using glue. **[2]**

Total [10]

Total for paper [50]

Mark Scheme 1957/04
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1 (a) (i) Advantage could include:
- all of model can be seen using rotation;
- easier to explain to client or other third party;
- can be used for export to machining file;
- realistic rendering possible;
- calculations based on mass or volume easier to carry out.

1 mark for a suitable advantage. **[1]**

(ii) Thickness of the material to be moulded, 1 mark.
accept sheet thickness 1mm – 3mm. **[1]**

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- use of recycling symbol
- use materials that can be recycled.

1 mark each for two methods. **[2]**

Total [10]

2 **(a)** Areas could include:
large numerals, sloping front for easy reading, easy access of buttons,
sound directed upwards, 1 mark for each relevant area, max. 2 **[2]**

(b) **(i)** Electric shock warning, CE mark or double insulation symbol. 1 mark **[1]**

(ii) The battery is used for back – up in cases of mains failure.
It will retain the time/alarm settings, 1 mark for relevant reason. **[1]**

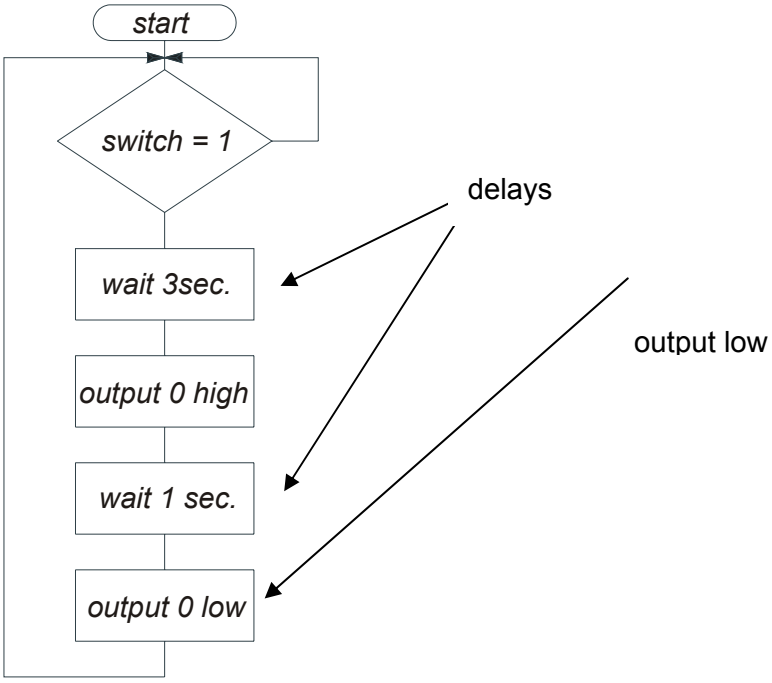
(c) Slide switch will retain the setting (bistable action), allowing the waveband setting to be retained, allow indicates whether set to AM or FM,1 mark
Press switch is momentary as minute/hour setting will require only single pulses before release, (monostable action), 1 mark **[2]**

(d) **(i)** Clear drawing and/or description 1 mark, effective method used, 1 mark. **[2]**

(ii) The device will be moved and possibly subject to vibration in transit, the glue ensures that fragile components will not move under vibration, allow settings on presets and variable components are not lost, economical method of fixing when repair is not likely. 1 mark for identifying reason, 1 mark for identifying likely result of not using glue. **[2]**

Total [10]

3 (a) (i) 1 mark for both delays correct, 1 mark for output 0 low. **[2]**



(ii) Highest number that can be stored is 255. **[1]**

(iii) Advantages could include accuracy of delays, reduction in cost of components, less board space used, delays can be changed easily, only needs software alteration to change.
1 mark each for two valid advantages. **[2]**

(b) (i) Corrections required are:
relay should be connected to collectors and positive rail, not 0V rail.
diode is connected the wrong way round.
1 mark for each valid reason. **[2]**

(ii) Load on the motor may increase either at start or if the wiper blades are frozen to screen, allow mechanism jammed.
1 mark for understanding shown. **[1]**

(c) Substituting into formula either $W = V \times I$ or $W = V^2 / R$
$W = 12 \times 2.31 = 27.7$ 1 mark or
$W = 12^2 / 5.2 = 27.7$ 1 mark.
Correct answer 27.7 1 mark.
Correct answer no working, give 2 marks. **[2]**

Total [10]

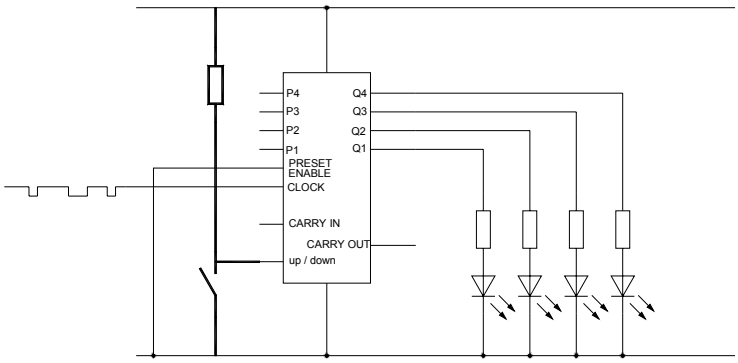
4 (a) (i) The likely result is erratic counting due to the contact bounce, award 1 mark for understanding. **[1]**

(ii) Resistors X and Y are **pull up resistors**, they will hold the signal at a **logic level**.
Allow limit current to the microswitch.
1 mark for either or for understanding shown. **[1]**

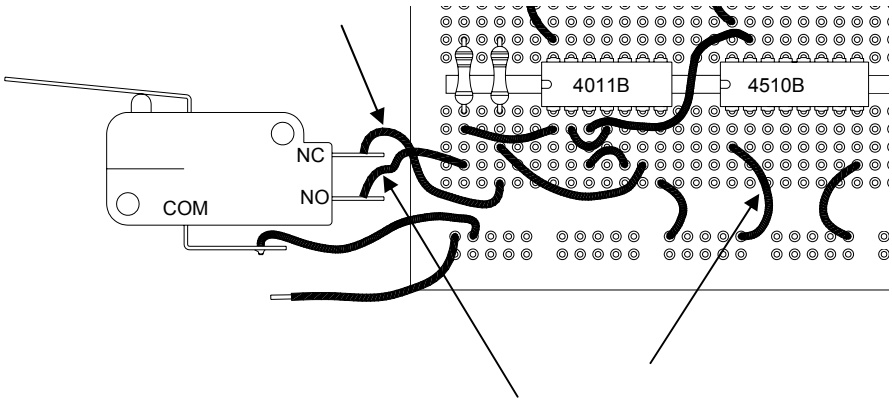
(iii) Switch needed is **SPDT** all letters must be correct for the mark. **[1]**

(iv) The switch could be inverted using one of the spare NAND gates as an inverter 1 mark,
Using the Q output, 1 mark.
Reverse connection to R&S 1 mark. **[2]**

(b) (i) 1 mark for switch, 1 mark for resistor,
allow marks if the resistor is connected low and switch high. **[2]**



(ii) 1 mark for NC connected to pin 6 either direct or via resistor.
1 mark for NO connected to pin 1 either direct or via resistor.
1 mark for PE, (pin 1 of 4510), connected to 0V, total 3.
Allow reversed connections of NO / NC.



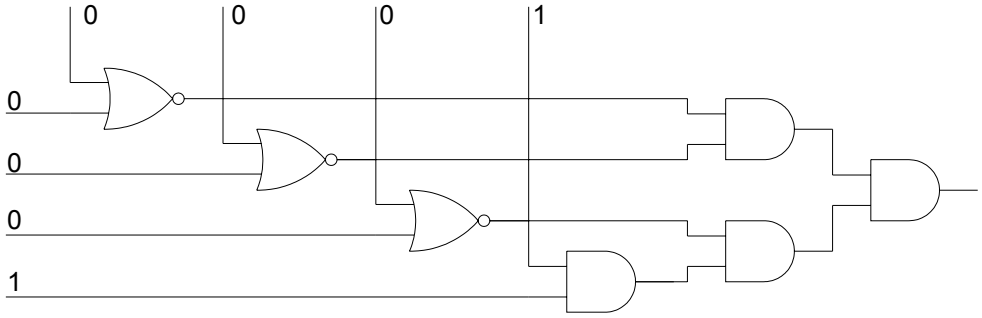
[3]

Total [10]

5 (a) (i) Reasons for choosing keypad – card cannot be lost or copied, direct entry system,
less to go wrong, code can be changed without issuing new cards,
each user does not have to be issued with a card.
1 mark for relevant reason. **[1]**

(ii) Once punched the code cannot be changed, all of the other methods will allow a change of code, punched card is easier to copy. 1 mark. **[1]**

(b) (i) 1 mark for inputs 1,2,3,4, 1 mark for codes 1,2,3,4. **[2]**

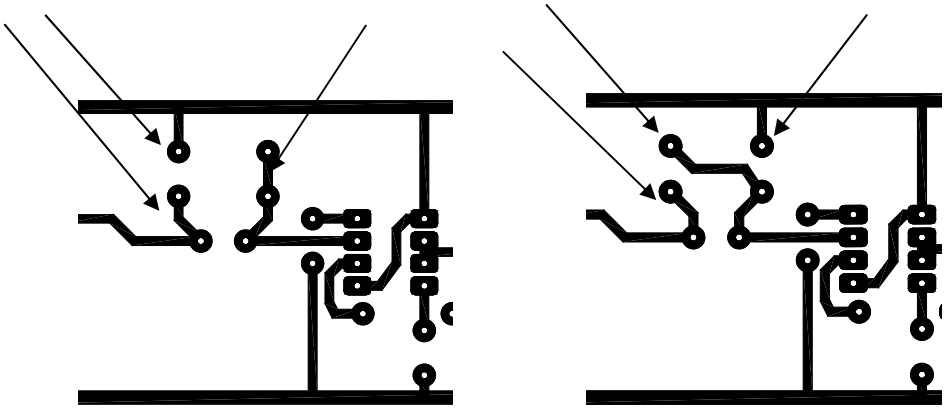


(ii) Magnitude comparator will allow the code to be changed easily using input switches, once the logic system is built it is not easy to change the code.
1 mark for understanding shown. **[1]**

(c) (i) 1 mark for either **inverting** the signal or **amplifying** the signal for use as trigger. **[1]**

(ii) If the trigger pulse is left low the monostable will **continue to trigger** 1 mark, and the **output will stay on** 1 mark. **[2]**

(iii) Either end of resistors connected correctly 1 mark,
two resistors and capacitor connected together, 1 mark. **[2]**



Total for paper [50]

Mark Scheme 1957/05
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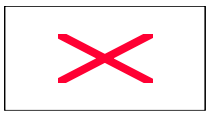
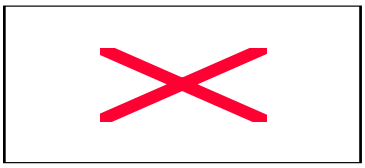
1 A Reservoir (or air tank) **[1]**

B **[1]**



C **[2]**



D 3/2 **[2]**
Spring return
push button valve (any two)

E Shuttle valve (or flip / flop or one way valve [1 mark] **[2]**

F Restrictor or Flow Control Valve FCV **[2]**

2 (a) (i) The single acting cylinder will outstroke (1), the speed (slowly?) depending on the setting of the Restrictor (1), the easy route through the unidirectional restrictor is blocked (1). Cylinder will remain outstroked (1) Any Three **Max [3]**

(ii) The single acting cylinder will instroke [1] quickly because there is an easy route through the unidirectional restrictor. (1) Ball blows off (1) Any two **Max [2]**

(iii) The single acting cylinder will not move, or move slightly depending on the setting of the unidirectional restrictor. **[1]**

(b) The spring in the single acting cylinder will return the press to the start position (1), by exhausting the air through port 3 (1). **Max [2]**

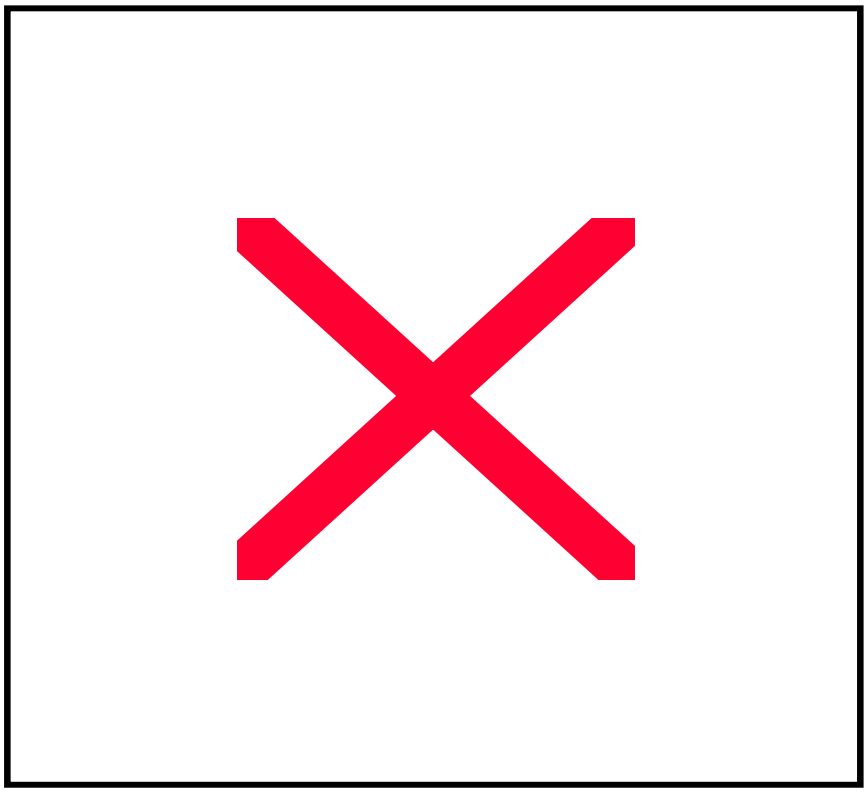
(c) The single acting cylinder will outstroke quickly (1) and when the button is released it will instroke quickly (1). **Max [2]**

3 **(a)** When the push button valve is pressed, the 5/2 valve changes state (1) and air flows to outstroke the cylinder (1) and through the restrictor (1) into a reservoir (1) where the pressure rises (1) and after a time sufficient pressure (1) switches the pilot port of the 5/2 valve (1). **Max [4]**

(b) The delay can be adjusted by adjusting the restrictor (or Flow control valve). **Max [1]**

(c) A cushioned cylinder. **[1]**

(d) Threaded hole (1)
Thread on piston rod (1)
Locknut (1)
Communication (1) **[4]**



4 **(a)** Two reasons for using CAD to model a prototype pneumatic circuit.
The circuit can be simulated.
The circuit can be tested.
Quicker and Cheaper must be qualified
Any other correct response, (1) mark each. **Max [2]**

(b) The circuit can be modelled and the tested.
The circuit can easily be evaluated.
The circuit can be modified and retested.
The circuits can be easily changed.
Quicker and Cheaper must be qualified
Any other correct response, (1) mark each. **Max [2]**

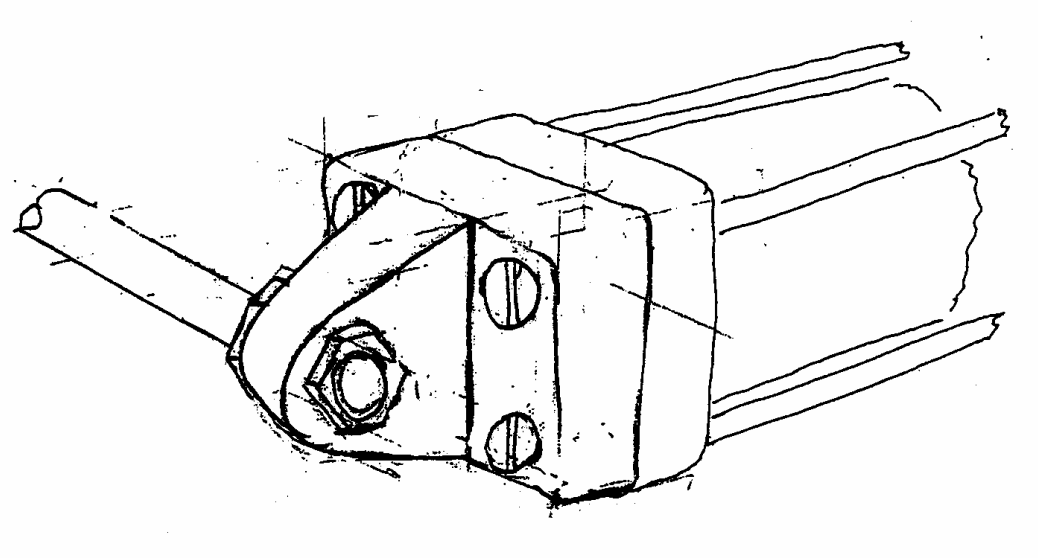
(c) The reed switches are operated by the magnet, which is fixed to the piston and moves with it. **[1]**

(d) Electronic circuit:
When the cylinder has outstroked it has opened reed switch 1 (1) and closed reed switch 2 and the signal has been sent to the computer (1). **Max [2]**

Pneumatic circuit:
Computer sends a signal to port 14 of the 5/2 (1) and main air is sent to the cylinder (1), which causes the cylinder to instroke (1). **Max [3]**

5 **(a)** Fixed to piston rod (1)
Locked on piston rod (1)
Connects to arm (1)
Free movement on arm (1)
Communication (1) **[5]**

(b) Fixed to Ø10 bolt (1)
Locked on thread (1)
Fixed to two Ø6 holes (1)
Fixed to all Ø6 holes (2)
Communication (1) **[5]**



Mark Scheme 1957/06
June 2005

1 (a) Two reasons for using CAD to model a prototype pneumatic circuit.
The circuit can be simulated.
The circuit can be tested.
Quicker or Cheaper must be qualified
Any other correct response, (1) mark each. **[2]**

(b) The circuit can be modelled and the tested.
The circuit can easily be evaluated.
The circuit can be modified and retested.
The circuits can be easily changed.
Quicker or Cheaper must be qualified
Any other correct response, (1) mark each. **[2]**

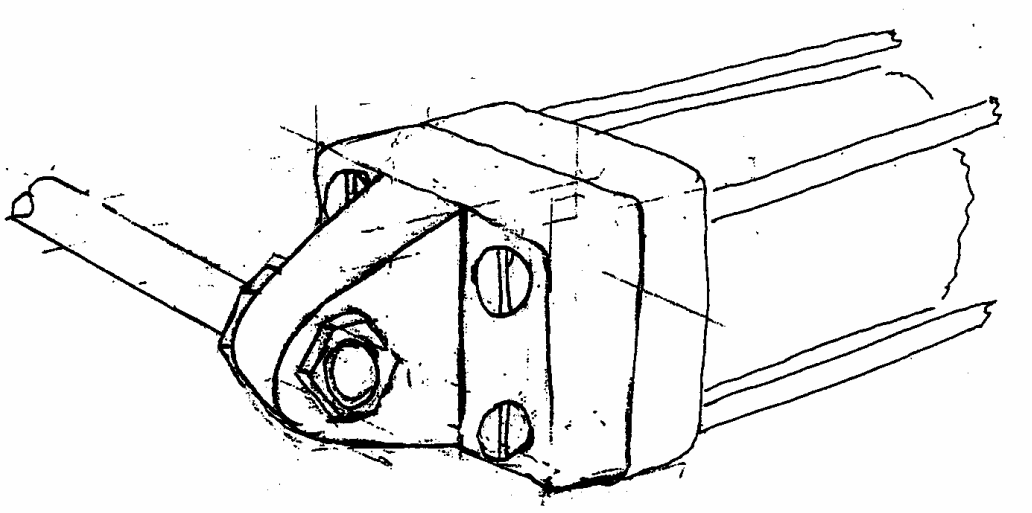
(c) The reed switches are operated by the magnet, which is fixed to the piston and moves with it. **[1]**

(d) Electronic circuit:
When the cylinder has outstroked it has opened reed switch 1 (1) and closed reed switch 2 and the signal has been sent to the computer(1). **[2]**

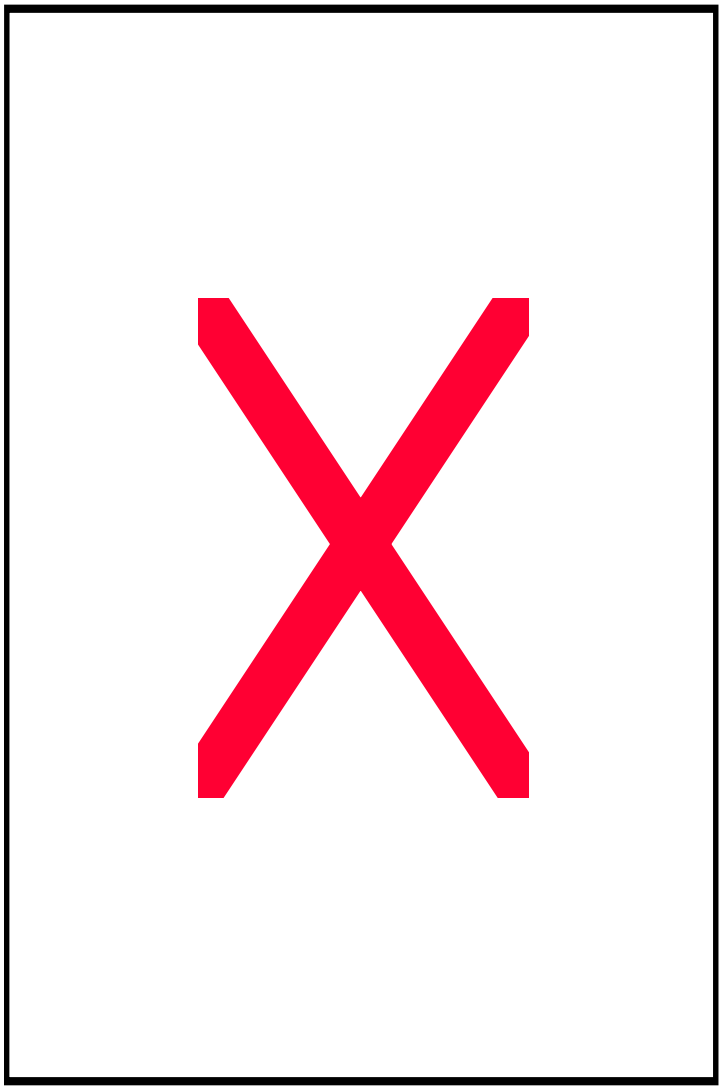
Pneumatic circuit:
Computer sends a signal to port 14 of the 5/2 (1) and main air is sent to the cylinder (1), which causes the cylinder to instroke (1). **[3]**

2 **(a)** Screwed to piston rod (1)
Locked on thread (1)
Connects to arm (1)
Free movement of arm (1)
Communication (1) **[5]**

(b) Fixed to Ø10 bolt (1)
Locked on thread (1)
Fixed to 2 Ø6 holes (1)
Fixed to all Ø6 holes (2)
Communication (1) **[5]**



3 (a) It is important to send a feedback signal when the doors are fully open (1) or fully closed (1). It could be a safety hazard if the doors were open and the machine could be started (1). **[3]**



[7]

4 (a) Name AND function **[1]**
Both X AND Y must be pressed (1) before there is an output. (1) **[2]**

(b) Name OR function **[1]**
X OR Y must be pressed (1) before there is an output. (1) **[2]**

(c) An air group air system was necessary because when cylinder B tried to go negative there was signal keeping it positive (1) making a dual signal on Cylinder B. By dividing the circuit into two air groups (1) and switching between the two the circuit would work.(1) **[3]**

(c) Between Cylinder B going positive and negative / After B+ / B+ here B- **[1]**

5 (a) Calculate the diameter of the piston required.

$F = P \times A$

$100 = 0.6 \times A$

A = 166 or 167 (1)

$A = \pi r^2$

$r = \sqrt{\frac{166}{\pi}}$ (1)

r = 7.27mm D = 14.52

Diameter = 14.52mm

(1) mark for the correct diameter (1) mark for mm **[4]**

(b) Cylinder C is the most suitable cylinder. **[1]**

(c) With no wheel in place air will escape through the air bleed, (1) and the diaphragm valve will stay relaxed, (1) and there will be no supply to the rest of the circuit (1).
When a wheel is in place the air bleed is blocked, (1) and supplies main air to the rest of circuit (1). **[5]**

Total: [50]

Mark Scheme 1957/07
June 2005

1 **(a)** component A : crank; handle. (1)
component B: axle; crank shaft; cam shaft; drive shaft; (1)
component C: follower; push rod (1) **[3]**

(b) crank turned; handle turned; rotary motion; A turned; (1)
process (1)
output (1) **[3]**

(c) (i) cam E (1)

(ii) cam D (1) **[2]**

(d) increased length of crank; increased thickness of handle;
increased length of handle;
solution (1)
communication (1) **[2]**

Total marks [10]

2 **(a)** class 1; 1st order; **[1]**

(b) A: effort
B: pivot; fulcrum
C: load **[3]**

(c) Calculation – MA = 120/20 (1)
= 6 (1) **[2]**
Note: award 2 marks for correct answer
One mark only for 20/120 (application of sizes)

(d) (i) spring; spring steel; (1)

(ii) position indicated between handles (1) **[2]**

(e) (i) polypropylene, HDPE, ABS, polymorph; PVC; thermoplastic; (1)
Not acrylic; nylon; HIPS

(ii) injection moulding, dip coating (1) **[2]**

Total marks [10]

3 **(a)** increased mechanical advantage; increase force decrease effort;
less force is required; (1)
explanation of how MA is increased relating to pulley system (1) **[2]**

(b) rope will stretch; increased distance effort has to travel;
danger of tripping over rope; rope getting caught in tree;
chaffing of rope; rope snap; safety issues; **[1]**

(c) Easier cutting; no need for lubrication; prevention of rust;
prevention of gumming; **[2]**

(d) prevent wear between the two metal surfaces; reduce friction;
cover sharp end of lower tube; help to prevent corrosion;
compensate for gap between common stock sizes; **[1]**

(e) each specification point addressed: adjustment **A** (1)
series of holes acceptable
no weakness **W** (1)
holes = weakness therefore no mark
easy operation **E** (1)
cam or wing nut acceptable
not nut and bolt
lock **L** (1)
Cam lock ideal solution **[4]**

Total marks [10]

4 **(a)** holes drilled accurately on both components (1)
before assembly ensures fit; (1)

hinge component accurately machined (1)
to fit inside leg ensures fit; (1)

robotic assembly of components and fixings (1)
lower labour costs;(1)
award 1 mark for valid point with no explanation
award 2 marks for two well explained advantages that may relate to quality control or quality assurance **[4]**

(b) original design can be easily modified; VR modelling of designs **[1]**

(c) smaller quantities of the additional parts can be manufactured as required while the main production of the common parts continues.
Ability to respond to change in market;
General answer about batch production 1 mark.
2nd mark related to profitability. **[2]**

(d) folding parts: to prevent trapping of fingers, compact
adjustment parts: ease, comfort, safety

clear reference to mechanical parts/system 1mark
related to ergonomic features/issues 2nd mark
general comment about ergonomics 1mark
related to anthropometrics during designing stage 2 marks **[2]**

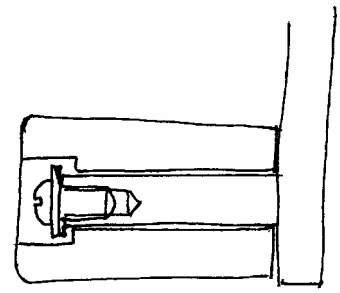
(e) materials; tolerance; joints; finish; **[1]**

Total marks [10]

5 **(a) (i)** rack and pinion 1+1 (2)

(ii) **rotary** motion of the crank is converted to **linear** motion of the pillar by the pinion meshing with the rack (2)
note: 1 mark only for description that does not refer to rotary and linear motion. E.g. handle turned pillar moves up and down **[4]**

(b)



rotate R (1)
secure S (1)
communication of correct part solution C (1) **[3]**

(c) marks to be awarded for sketches which **clearly** show S (1)
prevention of rotation R (1)
while
allowing shaft to slide inside cylinder A (1) **[3]**

Total marks [10]

Paper Total [50]

Mark Scheme 1957/08
June 2005

1 **(a)** holes drilled accurately on both components (1)
before assembly ensures fit; (1)

hinge component accurately machined (1)
to fit inside leg ensures fit; (1)

robotic assembly of components and fixings (1)
lower labour costs;(1)
award 1 mark for valid point with no explanation
award 2 marks for two well explained advantages that may relate to quality control or quality assurance **[4]**

(b) original design can be easily modified; VR modelling of designs **[1]**

(c) smaller quantities of the additional parts can be manufactured as required while the main production of the common parts continues.
Ability to respond to change in market;
General answer about batch production 1 mark.
2nd mark related to profitability. **[2]**

(d) folding parts: to prevent trapping of fingers, compact
adjustment parts: ease, comfort, safety

clear reference to mechanical parts/system 1mark
related to ergonomic features/issues 2nd mark
general comment about ergonomics 1mark
related to anthropometrics during designing stage 2 marks **[2]**

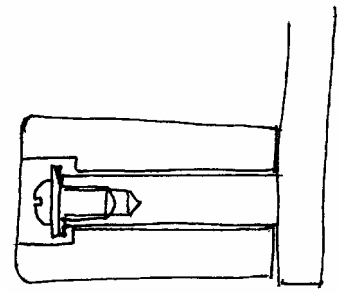
(e) materials; tolerance; joints; finish; **[1]**

Total marks [10]

2 **(a) (i)** rack and pinion 1+1 (2)

(ii) **rotary** motion of the crank is converted to **linear** motion of the pillar by the pinion meshing with the rack (2)
note: 1 mark only for description that does not refer to rotary and linear motion. E.g. handle turned pillar moves up and down **[4]**

(b)



rotate R (1)
secure S (1)
communication of correct part solution C (1) **[3]**

(c) marks to be awarded for sketches which **clearly** show S (1)
prevention of rotation R (1)
while
allowing shaft to slide inside cylinder A (1) **[3]**

Total marks [10]

3 **(a)** Calculations- **'A'** MA = 120/20 = 6 (1)
'B' MA = 120/60 = 2 (1)
Explanation (1) **[3]**
A good explanation with no calculations 2 marks

(b) (i) calculation of MA 150/15 =10 (2)
If 15/150 one mark only
(ii) Pulley system MA = 2:1 (2)
If 1:2 one mark only
(iii) Output force = 100N (2)
Calculation using incorrect answers from (i) and (ii) showing correct application and answer award 2 marks
Part calculation award 1 mark **[6]**

(c) Rope stretch; friction; too many moving parts; twist; **[1]**

Total marks [10]

4	**(a)**	sketches to show: engagement of dogs / drive	E	(1)	
		disengagement / free movement	D	(1)	
		notes / communication	C	(1)	**[3]**
	(b) (i)	coiled spring stores potential energy;		(1)	
	(ii)	unwinding spring converts to kinetic energy;		(1)	
		mechanical energy converted to electrical energy		(1)	
		electrical energy converted to light energy		(1)	
		accept mechanical to heat; electrical to heat			**[4]**
	(c)	VR = 75/15 x 75/15 (15/75 x 15/75)		(1)	
		X 30/5 (x 5/30)		(1)	
		= 150:1 (= 1:150)		(1)	**[3]**
					Total marks [10]
5	**(a)**	toggle clip; over centre locking;			**[1]**
	(b) (i)	locking: toggle lever – tighten		(1)	
		lock		(1)	**[2]**
	(ii)	adjustment: ratchet system – hold		(1)	
		release		(1)	**[2]**
	(c)	ball bearing; ball race; roller bearing; radial bearing;			**[1]**
	(d)	design to provide: support for wheel	S	(1)	
		pressure on outer ring of bearing	P	(1)	
		mechanical advantage	M	(1)	
		ability to reassemble	R	(1)	**[4]**
					Total marks [10]
					Paper Total [50]

Report on the Components
June 2005

GCSE Design & Technology Systems and Control 1957 - 2005

General

The examination papers this year were very successful in allowing candidates to score appropriate marks. The disappointment is the incorrect tier entry of a number of candidates. Centres do need to take care when entering candidates to ensure they can score well on each paper. The particular problem involves candidates failing to gain a grade on the higher papers. Candidates that can only gain a grade U on the higher paper have not had sufficient opportunity to display their knowledge and might have benefited from being entered for the foundation tier.

It is pleasing to see improvements have been consolidated with coursework. The performance this year was exactly the same as last year. Schools are now very comfortable with the assessment scheme. The number of changes moderators needed to make to bring the internally assessed component to the OCR standard was less, although some schools still failed to apply the strand marking correctly.

On the written papers the cross over questions on Industrial Application are still not receiving the attention in Centres they should. These 10 marks for each question must be covered as taught items. Candidates also need to understand about production processes. They should have direct knowledge of using jigs to control the quality of the production process.

Centres are now displaying more use and knowledge of CAD/CAM but there is still a gulf where it is not covered or the candidates do not have first hand knowledge of the processes.

Examiners are still having problems recognising diagrams that contain technical details. Candidates must practise drawing designs and proposals by hand. It is certainly a trend seen in coursework; design proposals are less clearly sketched.

Training is now more closely focused on the needs of Centres, with the meetings aimed at teachers new to the specification or those teachers who require specific guidance on preparing candidates for examinations.

1957 / 01 & 02 – Core Papers 2005

General Comments

The selection of candidates for appropriate tiers was a key element to their performance. The vast majority of Centres entered candidates for the correct tier. This demonstrated a positive response to previous reports which have stressed the need to enter candidates for the appropriate tier. Schools should note, however, that the design questions on the Higher Tier offer limited support information. These questions demand an independent approach to design, and as such are inappropriate for weaker candidates.

The ability of candidates to communicate their general ideas in the form of clear notes and sketches is improving. The quality of sketches demonstrated an improvement over previous years. The majority of candidates added notes to their sketches when required to do so, which increased their access to the marks available to them.

Questions relating to the use of SMART materials and an increased focus upon the topic of manufacturing in quantity were addressed by the majority of Centres. The overall responses demonstrated an improvement in understanding of these topics. In addition, where appropriate, the marking scheme was constructed to allow marks to be gained by candidates offering alternative, but correct responses.

Efforts have been made to improve candidate access to the questions. This has been done by altering the style of language used and in some cases making changes to the structure of the question. A number of candidates failed to show the steps involved in calculations. Almost all candidates attempted every question on the paper, which, suggests that access to the questions had been well considered.

Paper 01 - Foundation

Question 1.

(a) The question provided a good introduction to the paper, and was answered well by almost all candidates.

(b) Candidates answered this part of the question well. Candidates showed an improvement in their understanding of jigs over previous papers.

(c) Almost every candidate gained credit here, but only a small number achieved full marks by drawing a two point fixing system.

(d) A majority of candidates correctly named vacuum forming or injection moulding as a suitable process for forming the plastic tray. Many candidates correctly gave one advantage for the trolley as being a self assembly product, but often found it difficult to identify a second.

Question 2

(a) Few candidates were able to state an advantage to the manufacturer of having the body shells made from plastic compared to steel. Often they failed to state advantages from the correct viewpoint, i.e. that of 'the manufacturer'.

(b) Candidates generally provided correct responses to the first two boxes. Many, however, failed to recognise that the third box required a piece of hardware i.e. 'wheels', and many incorrectly stated 'movement' as an answer.

(c) Almost every candidate gave a correct response to this part of the question.

(d) Many candidates were able to obtain some credit for their answers using general technological principals. In general the quality of sketching was not good; however the majority of candidates used good notes or labels to explain their idea.

Question 3.

(a) Many candidates were able to gain one mark here, few gained two marks.

(b) This question generated fewer correct answers than expected. In energy conversion questions it is important that candidates use the correct terms.

(c) Many candidates gained some credit in this question. A significant number of candidates were unable to explain the purpose of the resistor in relation to the control of current.

(d) Many candidates were able to demonstrate their practical experience of soldering. Where candidates did lose marks they often incorrectly related their answer to faults with the circuit board.

(e) Here the vast majority of candidates demonstrated practical experience of soldering and were able to offer a wide range of acceptable responses.

Question 4.

(a) Most candidates gained one mark. Few were able to gain two marks. Many incorrect answers were given which related to the use of CAM.

(b) This part was answered well by many candidates. However, some Centres appeared unable to respond to this question. CAD/CAM is an important part of the specification which relates to modern manufacturing, and the ability to control the quality of the products manufactured.

(c) In general the responses to this question were disappointing. The control of quality in manufacturing relies heavily upon inspection and testing at critical control points.

(d) This part was well answered by most candidates.

(e) This part of the question was well answered with many candidates offering scientific terms such as 'Greenhouse Effect', 'Global Warming', and 'Acid Rain'.

Question 5.

(a) Many candidates gained marks on this part of the question. Candidates who failed to gain marks offered answers which were too general and failed to offer technical information for the first part of each response.
(b) Most candidates gained some credit. The quality of sketching for this type of question showed an improvement on previous years. The majority of candidates produced 3-D sketches showing the required detail. A number of candidates lost marks by failing to add notes to explain their improvements, as asked for in the question.
(c) Not all candidates focussed upon the cost factors as required by the question. Often a general statement explaining JIT was given which failed to gain marks.

Paper 02 - Higher

Question 1

(a) Most candidates gained one mark. Few were able to gain two marks. Many incorrect answers were given which related to the use of CAM.
(b) This part was answered well by many candidates. However, some Centres appeared unable to respond to this question. CAD/CAM is an important part of the specification which relates to modern manufacturing, and the ability to control the quality of the products manufactured.
(c) In general the responses to this question were disappointing. The control of quality in manufacturing relies heavily upon inspection and testing at critical control points.
(d) This part was well answered by most candidates.
(e) This part of the question was well answered with many candidates offering scientific terms such as ‘Greenhouse Effect’, ‘Global Warming’, and ‘Acid Rain’.

Question 2.

(d) Many candidates gained marks on this part of the question. Candidates who failed to gain marks offered answers which were too general and failed to offer technical information for the first part of each response.
(e) Most candidates gained some credit. The quality of sketching for this type of question showed an improvement on previous years. The majority of candidates produced 3-D sketches showing the required detail. A number of candidates lost marks by failing to add notes to explain their improvements, as asked for in the question.
(f) Not all candidates focussed upon the cost factors as required by the question. Often a general statement explaining JIT was given which failed to gain marks.

Question 3.

(a) There were fewer correct answers than expected, and the quality of communication was generally not good.
(b) Many candidates failed to address all of the key words in the question. The blocks were to be ‘as light as possible’.
(c) This part of the question was generally well answered. The majority of candidates used complete sentences to explain their response.

(d) This style of question was answered better than on previous papers. Centres that had studied previous mark schemes had gained an insight into the level of response needed to gain marks, and had prepared candidates well. A common oversight was a failure to provide clamping of the tube.

Question 4.

(a) The majority of candidates answered correctly, although the numerical layout needs to be more logically laid out.
(b) This part of the question was not answered well. Understanding types of motion is an important part of understanding many control systems.
(c) A detailed understanding of the advantages of injection moulding was not clearly demonstrated by candidates.
(d) Few candidates offered the correct response 'repetitive flow'. Explanations referring to types of commercial production are given in the Subject Guidance.
(e) This part of the question was well answered by candidates from many Centres. However candidates from other Centres failed to gain any marks.

Question 5.

(a) Many candidates gained at least one mark.
(b) Most candidates attempted this part of the question which was pleasing. The majority of candidates planned their responses and paid careful attention to the three key specification points stated in the question. Successful candidates then addressed these points when sketching their design idea. They also used annotation to support the reason behind each of the three points. The quality of sketching here was generally good. Many candidates were easily able to communicate their ideas by sketching a central idea and using 'satellite' drawings to highlight detail.

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1957 / 03 & 04 – Electronics Papers 2005

General Comments

Papers 3 and 4 continue to provide a spread of marks across the full range. The papers once again included questions on CAD/CAM and product analysis for the two overlap questions answered by both tiers of candidates. The papers provided suitable differentiation and there was less evidence of questions being omitted by candidates than has been the case in the past. Level of entry again appeared to be a problem in a few cases. The foundation tier would have been more appropriate for some candidates and those candidates concerned would have found the questions more accessible. There is far less evidence of extremely able candidates being entered for the foundation tier.

Questions testing the practical processes were in general answered better than those that required knowledge of how components interact within a circuit. The product analysis question again proved to be a good method of differentiating between candidates. Knowledge of the vacuum forming process as a method of producing a casing was not universal; many candidates had clearly not seen or used the process.

Annotated sketches were in many cases not easy to follow, the available space had not been used to full advantage, which meant that detail was difficult to follow. The standard of writing again caused difficulty for examiners; candidates must try to ensure that their response can be deciphered. This year a few cases came to light of candidates answering the paper using a red pen. This must not be done to prevent confusion with the red marks used by examiners.

The use of inserted formulae sheets was probably a factor in the better performance of higher tier candidates on the calculation question.

The number of generic responses, e.g. ‘cheap’ and ‘easy’, seen this year was down on previous years. Candidates should be reminded that any reference to these terms should be comparative and reference should be made to the item or technique being compared to.

Paper 03 - Foundation

1 (a) This question was generally well answered with most candidates scoring at least 2 marks. Surprisingly a number of candidates included the given answer, 2, as one of their responses. A number of candidates gave ‘power’ as one piece of information.

(b) (i) The majority of candidates gave the value as one piece of information on the colour code, fewer were aware of the tolerance being indicated by the final band.

(ii) A number of correct responses related the lower tolerance to the resistance being closer to the stated value. The question did discriminate well in terms of resistor knowledge.

(c) A large majority of candidates related leg length with indication of polarity but rather fewer stated the correct polarity for each leg; however candidates who did this were not penalised.

(d) This part of the question was successful in highlighting the candidates who have a clear understanding of units and values of components.
Many gained one mark but few gained both. The most common error was to use nano farads instead of micro farads for the highest capacitor value.

2 (a) (i) Knowledge of logic at this level was not widespread. For those candidates who had knowledge of the basic functions the question was straightforward, however it

appeared that these candidates were in the minority. There was a clue in the rubric, which stated that either door switch 1 or door switch 2 could be used.

(ii) This question resulted in a range of responses for the component that could be replaced with a variable resistor. The most frequent response was R2, which was the base resistor for TR1 and 2.

(b) Those who had experience of using a multimeter gave the correct response to this question, it appeared that a number of candidates had failed to understand the action of a push to break switch.

(c) (i) The diode is a fundamental component of electronic circuits but the shape of the symbol is not well known. In a number of cases the drawing offered was an outline drawing of a diode, rather than the symbol. Confusion with the symbol for an LED or an amplifier was a common error.

(ii) Widespread understanding of the function of a diode as protection and as a one-way device. A small minority gave responses such as, 'slows down the current'.

(d) This part of the question did not provide many fully correct responses. The switching voltage for transistors was known by only a few.

(e) A well answered section with the majority gaining at least one mark. A number of advantages and disadvantages were acceptable responses but candidates should be reminded that cost, if given as a reason must be qualified. E.g. fewer lamps will be required, therefore the cost is lower.

3 (a) (i) In placing the listed items into the block diagram most candidates gained at least one mark. The most common error was in having the delay period before the device had been triggered.

(ii) The concept of resetting was generally understood but the actual result was often expressed the wrong way around, i.e. it was thought to restart the time delay.

(b) (i) Ability to identify items from a catalogue list is a practical skill that many will have used in their coursework. As such it was well answered.

(ii) A number of candidates displayed no knowledge of IC pin identification systems. The standard indents or dots were required, and were provided by the majority. Those who did not do this often numbered the pins incorrectly.

(c) (i) A sound knowledge of soldering was demonstrated in this part. Clear recognition of the faults was the norm, with marks being lost mainly for ambiguous or unclear responses.

(ii) Some excellent descriptions of suitable repairs were offered, those who failed to gain the marks generally offered short statements such as 'remove extra solder', what was required was *how* the extra solder could be removed.

4 (a) (i) The majority of candidates presented a viable advantage for 3D CAD software to gain the mark. Those that were not awarded a mark had generally not read the question fully. The requirement was for an advantage of 3D over 2D software not a general advantage of using CAD.

(ii) Those familiar with the vacuum forming process correctly gave the thickness as the extra dimension needed, those responses not accepted included the length and width of the sheet used.

(iii) This part of the question discriminated well; a large number cited corner rounding as a modification, rather fewer went for taper angle or draft on the sides.

(b) (i) Exported features of the circuit could have included track position or size, pad position or size and a number of other areas gained marks. Size of the board was also given credit.

(ii) This part was generally well answered with the majority describing how components can be placed correctly using the screen layer; somewhat fewer gained the second mark for describing how the component can be orientated.

(c) There was some confusion on the precise role of a designer in encouraging recycling; use of a recycling symbol on the product was the most frequent response along with using materials that can be recycled.

5 (a) Knowledge of the term 'ergonomics' was in many cases lacking, and it frequently became confused with aesthetics. There was a clear distinction between those candidates who were familiar with the term and gained 2 marks and those who had guessed and possibly gained a single mark.

(b) (i) Few candidates failed to gain a mark in this part, there were at least five references to safety that could have been used.

(ii) Use of the battery as a back up source of power was recognised by more able candidates, those who simply saw it as an alternative power source did not gain a mark.

(c) The different switch actions related to the bi-stable type action of the slide switch, which was suited to changing a waveband and the momentary action of a push or press switch, which is suitable for time changing. There were more good explanations for the slide switch than for the press switch

(d) (i) Marks were awarded for validity of solution and for the quality of communication; a number of very clear feasible ideas were presented by able candidates. Those who did not gain full marks had often secured the aerial outside the case, rather than inside.

(ii) Security of the components from the effects of vibration and shock were correctly given in responses, securing of variable component setting was less widely recognised.

Paper 04 – Higher

1 (a) (i) There were rather more valid responses for this part than in the Foundation tier. Many of the reasons given reflected the increased availability and use of 3D software.

(ii) The thickness of the plastic used was correctly identified by the majority as the missing dimension.

(iii) A number of responses indicated how the raised section for switches and display could be formed, most however went for rounded corners and tapered sides.

(b) (i) A lot more correct answers for the exported features than appeared in the Foundation question.

(ii) The majority recognised that the screen layer will indicate component position; rather fewer saw the implications for orientation and value of component.

(c) Many candidates gained one mark for use of a recycling symbol and the second mark provided good differentiation, more able candidates mentioned the way that the product can be designed to break down into smaller units for recycling.

2 (a) Understanding of the term 'ergonomics' was far better at this level with most candidates gaining at least one mark.

(b) (i) Very few failed to gain the mark for visible safety information.

(ii) This part was also answered well; the main error was in thinking that the battery was an alternative supply for normal use.

(c) Understanding of the switch actions was not universal, the question differentiated clearly between those who knew and understood the two types of switch and those who were merely guessing.

(d) (i) The responses offered showed good communication ability in many cases. The principles used were more often valid than found in answers to the foundation paper and candidates showed better understanding of current commercial practice.

(ii) The majority of candidates gained at least one mark, normally for stating the anti-vibration action of the adhesive though a clear explanation of the reason for this being required was frequently omitted.

3 (a) (i) Understanding the waveform shown in the graph proved hard for many and a frequent error was to put the *off* and the *on* time at 3 seconds, with the final output being left at high.

(ii) There was some confusion as to what constituted a decimal number; in this case many responses were given as 0.9. Despite the rapid increase in PIC circuits for the coursework project the value of a single byte being 255 was not widely known.

(iii) The greater level of accuracy and consistency was recognised as an advantage by many, ease of changing delays was also a popular response.

(b) (i) Responses to this part generally lacked clarity and accuracy. The incorrect diode position was recognised by many; the incorrect relay connection by far fewer. A number of candidates were under the impression that the motor was not actually connected to the relay.

(ii) Not many candidates recognised the part played by snow and ice in overloading the motor, but the recognition of something 'jamming' the wiper was sufficient to gain the mark.

(c) This question was in general very well answered, certainly in comparison to other calculations in recent papers. A high proportion gained both marks.

4 (a) (i) There was very little understanding of contact bounce shown in the responses. A number of those who gained the mark limited their description to 'inaccurate', at this level a few more words could make all the difference in demonstrating their understanding.

(ii) The concept of a resistor being used as a 'pull up' device to ensure a valid logic level at all times was not widely known. Those who went for the more functional reason of limiting current to the micro switch were rewarded with a mark.

(iii) Knowledge of switch types was somewhat sketchy for many candidates. In a question aimed at 'A' grade it is expected that correct names for categories of switch would be known.

(iv) The question required the most economical methods of inversion. Reversing connection of R and S was given by rather more than used the opposite output at Q bar.

(b) (i) A number of candidates gained one mark for putting either a switch or a resistor from the up/down pin to one of the power rails. Very few completed the exercise to allow either up or down to be easily selected.

(ii) The majority of candidates scored one mark for connecting the preset enable to 0V. A number of errors were made in the other connections by using an already occupied hole in the breadboard or by not using the schematic circuit of the bi-stable circuit to identify the connections.

5 (a)(i) This part provided some clearly reasoned responses with many citing the ease of changing the code with a keypad system or the fact that the card cannot be lost or copied.

(ii) The majority of candidates picked up on the problems of forgery with punched cards, thereby gaining the mark.

(b) (i) Those centres who had covered logic gate functions provided candidates with the means of solving the codes. A significant number of candidates either guessed or used standard denary numbers in the response space.

(ii) Very few candidates scored on this part of the question. The intention of describing the magnitude comparator in some detail was that it could be seen that changing code was possible whereas the logic gates only provided one code.

(c) (i) Part A of the circuit was widely recognised as providing an input to the system, but the precise nature of how the signal was inverted and amplified was not widely recognised.

(ii) Knowledge of the way that a 555 timer IC triggers was not universal. Many candidates did not see that a constant pulse would keep re-triggering the timer. However marks were gained for recognising that the output stayed on with the lock in the open position. It is worth noting that simply repeating the question, as a number of candidates did, will not gain a mark.

(iii) The majority of candidates gained one mark for completing the PCB layout; rather fewer gained the second mark. In the case of those who gained both marks they had frequently drawn in the outline of the components to help their understanding. This is a worthwhile tactic when working with unfamiliar PCB's.

1957 / 05 & 06 – Pneumatics Papers 2005

General Comments

In general the standard of written responses was the same as in 2004. However, there were some scripts that were very difficult to read. An improvement in diagram/sketch responses and quality of presentation was noticeable, especially on the Foundation tier paper.

Paper 05 – Foundation

1. Sections A to F were generally well done. Some candidate drawings for C were not well drawn with important detail missing. Few candidates responded correctly to E – Shuttle valve.

2. (a) (i) Most candidates gained a reasonable number of marks. Many wrote about what happened to component A and failed to mention the restrictor effect of B and what happened to the single acting cylinder C.
   (ii) Most candidates knew that the spring returned the Cylinder but failed to mention that the ball 'blows-off' its seat allowing the rapid release of air pressure and the quick return of the cylinder.
   (iii) A large number of candidates mentioned that the cylinder may 'shudder' or move slightly / momentarily.
   (b) Most candidates identified the spring (1 mark) and some candidates also referred to the air exhausting through port 3 (1mark).
   (c) Many candidates stated that the speed would change in both directions.

3 (a) Few candidates gained full marks. Many knew that component E had something to do with time delay and that D controlled the flow. Many candidates failed to give a correct description. A small number of candidates wanted to add to / enlarge the reservoir.

   (b) Of the candidates who responded, only a few referred to adjusting component D.
   (c) Only a very small number of candidates knew of a 'cushioned cylinder'
   (d) The quality of sketches and notes varied considerably. The size of the given press tool and piston rod enabled many candidates to draw a reasonable response. Many candidates failed to recognise that the piston rod needs to be locked onto the press tool. Some candidates mentioned 'welding / brazing' when the question was specific about the device being able to be taken apart.

4 This question was by far the most consistently well answered question on the paper despite responses including 'quicker / cheaper' for CAD.

   (a) Answers including 'simulation' and/or 'easily tested' gained full marks.
   (b) Many candidates missed the fact that the question asked for the advantages to the manufacturer of CAD in the design development of pneumatically controlled machines.
   (c) Few candidates knew that the piston contained a magnetic piston ring. The proximity of the piston closes the reed switches in the diagram. Where this knowledge was missing, all candidates at the same centre were similarly affected.
   (d) (i) Where knowledge of (c) above was correct, candidates generally described the action in the electronic circuit correctly.
   (ii) Of the candidates who responded, all described the action in the solenoid valve correctly.

5 Most candidates gained some marks for this question.

(a) Some candidates failed to locate the details of Fig. 8 on Fig.7 and consequently drew the piston rod screwed into the given hole of the operating arm at 90°. Many candidates drew a coupling that would work in the correct orientation and allow free movement on the arm. Many candidates omitted a locking device to secure their coupling to the threaded piston rod.

(b) Most candidates included the use of 2 or 4 of the Ø6 threaded holes in their solution. As with part (a) some candidates drew a solution that turned the Ø10 bolt through 90°. The communication on this response was much better than in (a) reflecting perhaps a greater experience within the candidature cohort of this type of coupling.

Paper 06 – Higher

1. This question was generally well answered despite responses including ' quicker / cheaper' for CAD.

a) Answers including 'simulation' and/or 'easily tested' gained full marks.
b) Many candidates missed the fact that question required the advantages to the manufacturer of CAD in the design development of pneumatically controlled machines.
c) Few candidates knew that the piston contained a magnetic piston ring. The proximity of the piston closes the reed switches in the diagram. Where this knowledge was missing, all candidates at the same centre were similarly affected.
d) (i) Where knowledge of (c) above was correct, candidates generally described the action in the electronic circuit correctly.
(ii) Of the candidates who responded, all described the action in the solenoid valve correctly.

2(a) Most candidates gained some marks for this question. Some candidates failed to locate the details of Fig.8 on Fig.7 and consequently drew the piston rod screwed into the given hole of the operating arm at 90 degrees. Many candidates drew a coupling that would work in the correct orientation and allow free movement on the arm. Many candidates omitted a locking device to secure their coupling to the threaded piston rod.

(b) Most candidates included the use of 2 or 4 of the Ø6 threaded holes in their solution. As with part (a) some candidates drew a solution that turned the Ø10 bolt through 90°. The communication on this response was much better than in (a) reflecting perhaps a greater experience within the candidature cohort of this type of coupling.

3. A well answered question, especially the flow chart in part (b)

(a) Many candidates responded correctly. However, a small number of candidates failed to explain that the system needed a feedback signal to give information that the sliding door was 'open' or 'closed'. It would be a major safety hazard if the machine could be started with the door 'open'. Candidates who included this hazard or mentioned safety scored the higher marks.

(b) Most candidates drew a flow chart using the symbols given. A few candidates did not use the symbols for the correct activity, especially to match the question statements to the decision boxes. Feedback loops correctly/incorrectly drawn were the largest discriminator of marks.

4. (a) Most candidates gave the 'AND' function correctly and fully explained that both valve X and Y need to be pressed.

(b) Most candidates gave the 'OR' function correctly and explained that either valve X or Y needed to be pressed. A few candidates went on to explain the action of the ball within the shuttle valve.
(c) Some candidates had obviously been taught about group air systems. 'half- porting' was a popular expression used by some candidates to explain the need for two groups of air supply.
(d) There were many ways of highlighting the changeover point in the sequence. The marks scheme ensured that all methods and annotations were accepted (after B+, before B- etc).

5.(a) (i) Many candidates could not work out the area of a circle despite the given formula in the (inserted) 'Formulae Sheet'. Some candidates managed to get as far as 100 = 0.6 x A. A few candidates gave the result of their calculation as a value for the radius and many failed to put 'mm' in their final answer

(ii) A small number of candidates managed to select cylinder C as being the next size up to the correct result 14.52mm.

(b) There were many good answers to this part of the question with many candidates expressing in their own way what happens with the air bleed occlusion in this application. Unfortunately a small number of candidates gave a reverse view with the absence of the wheel enabling the circuit to work.

1957 / 07 & 08 Mechanisms Papers 2005

General comments

The papers were accessible to all candidates with good attempts to answer questions being made by all abilities throughout the papers. Issues relating to candidates' care when reading questions have been raised in previous reports and in training and it was pleasing to note that there were fewer problems relating to the misreading of questions this year.
It is important to remind Centres that questions are written to cover the whole specification including ICT and Industrial Applications, and that technical language in relation to mechanical systems and components is used and expected in candidates' responses.

Paper 07 - Foundation

1. The context for this question was a simple crank and cam operated automaton. Candidates were clearly familiar with this type of project and responded well.

   (a) The majority were able to gain at least two marks when naming the components in the system. 'Handle' was the most popular acceptable response to A although 'crank', the more technical term, was given by a reasonable number of candidates at this level. Camshaft seems to be well known although examiners were able to accept 'crankshaft' as a correct response to B. Part C, the cam follower, was less well known.

   (b) Most candidates were able to interpret a simple mechanical sequence into a block diagram.

   (c) This question was answered well by most candidates. They were able to interpret a simple description of mechanical movement in order to correctly identify the required cams.

   (d) The most common assumption by candidates is that a longer or thicker handle would improve the ease of turning the crank. Although this would make it easier to hold the handle it would not improve the mechanical advantage. One mark was awarded for this solution. The addition of bearings between the shaft and box was not acceptable as the question required a modification to component A. The best answers gave a clear annotated sketch showing increased length of the crank.

2 (a) The class of levers is generally well known by candidates.

   (b) Candidates are clearly aware of the parts of the lever system, with the pivot correctly identified by the majority; however there is some confusion as to which the effort is and which the load is.

   (c) Candidates who gave the correct answer to the mechanical advantage of the lever system without giving the calculation were awarded full marks. However candidates should be advised that marks are awarded for application of correct sizes even when the final answer may be incorrect.

   (d) This was well answered with most candidates suggesting that a spring would be appropriate and being able to clearly indicate a suitable position.

   (e) Candidates' knowledge of materials for specific purposes and methods of production is still a weakness. A significant number of those who gave an answer to this question incorrectly gave 'acrylic' and 'vacuum forming'.

3 (a) Although many candidates were able to gain one mark, few were able to convince examiners that they were aware of the significance of the two pulleys in reducing the effort needed to cut branches.

(b) The majority of candidates recognised that damage to the rope would be a disadvantage and gained full credit for this. It is disappointing to note that the consequence of the mechanical advantage achieved in a pulley system, which results in a large length of rope having to be pulled, was not recognised.

(c) Most candidates were able to gain one mark by suggesting that Teflon gave protection against rust or corrosion. Teflon is now a widely used modern material in the reduction of friction and in the prevention of a build up of contaminants, and it was disappointing to see little awareness of this in candidates' responses.

(d) The majority of candidates were able to correctly recognise the application of the bearing in the need for the tubes to slide easily or in keeping the tubes apart.

(e) The locking mechanism resulted in some very creative solutions and it was encouraging to see solutions which had been adapted from similar applications such as cam and lever locking systems used on bicycle seat stems. Candidates who addressed the specification points in their answers were able to gain credit for each feasible solution even when a complete solution was not given.

4 (a) Candidates' knowledge of CAM is still weak in the majority of Centres. The most common responses included 'quicker' and 'less workers' with no explanation of the significance of these. Few candidates were able to relate their answers to the specific situation in the question of fitting parts together and the need for close tolerance or the guarantee that spare parts would fit.

(b) Most candidates were able to give an acceptable answer which related to the ability to easily make or view changes to the design.

(c) Many candidates who attempted this question gave vague general answers about batch production suggesting little understanding. Very few could explain how batch production could respond to the need for additional parts to be added to the standard product to ensure profitability.

(d) The significance of ergonomics does not appear to be generally understood and few candidates attempted to relate their answers to any mechanical part of the tripod.

(e) There were some good, relevant answers relating to fitting of parts or correct functioning of parts such as hinges. However many answers focussed on the design of the product and could not be credited with a mark.

5 (a) The rack and pinion gear system is well recognised by most candidates and many are able to correctly describe the conversion of motion within the system, although not always using technical vocabulary.

(b) Although many candidates were able to address the need for the hand grip to rotate or to remain securely attached many answers failed to gain full marks because a satisfactory solution to only one of the requirements was given.

(c) Candidates' knowledge of keys and keyways is weak with a significant number giving drawings of door keys or locking pins.

Paper 08 - Higher

Questions 1 and 2 are common questions with paper 7 and although the higher tier candidates are generally able to answer in greater depth, often the content of answers is broadly comparable with those seen in paper 7

1 (a) Candidates' knowledge of CAM is still weak in the majority of Centres. The most common responses included 'quicker' and 'less workers' with no explanation of the significance of these. Few candidates were able to relate their answers to the specific situation in the question of fitting parts together and the need for close tolerance or the guarantee that spare parts would fit.

(b) Most candidates were able to give an acceptable answer which related to the ability to easily make or view changes to the design.

(c) Many candidates who attempted this question gave vague general answers about batch production suggesting little understanding. Very few could explain how batch production could respond to the need for additional parts to be added to the standard product to ensure profitability.

(d) The significance of ergonomics does not appear to be generally understood and few candidates attempted to relate their answers to any mechanical part of the tripod.

(e) There were some good, relevant answers relating to fitting of parts or correct functioning of parts such as hinges. However many answers focussed on the design of the product and could not be credited with a mark.

2 (a) The rack and pinion gear system is well recognised by most candidates and many are able to correctly describe the conversion of motion within the system although not always using technical vocabulary.

(b) Although many candidates were able to address the need for the hand grip to rotate or to remain securely attached many answers failed to gain full marks because a satisfactory solution to only one of the requirements was given.

(c) Candidates' knowledge of keys and keyways is weak with a significant number giving drawings of door keys or locking pins.

3 (a) Candidates were required to compare and explain the cutting action achieved in two different positions by using calculation. Candidates who were unable to use appropriate calculations were able to gain credit for a good explanation.

(b) This question required candidates to demonstrate their understanding of how sub-systems are combined. While the majority are able to recognise and calculate mechanical advantage in a lever system the significance of the two pulleys was not evident to many candidates. Candidates who applied their results correctly from parts (i) and (ii) in the calculation of the cutting force in the system were able to be awarded full credit even if the final answer was incorrect.

(c) The reasons for reduced efficiency in the system were well understood.

4 (a) Candidates were able to give clear sketches showing the action of a dog clutch. However there is evidence to suggest that a significant number are not aware of this common mechanical component.

(b) This question revealed a weakness in the coverage of the specification with a significant number of candidates apparently unaware of types of energy.
Part (ii) was often misread by candidates who gave a simple list of types of energy rather than giving energy transfers which were taking place in the torch.

(c) While many candidates are able to calculate velocity ratio in a simple gear train, knowledge of how velocity ratios are calculated in compound gear systems is less well known.

5 (a) The use of toggle clamps in locking systems is not well understood.

(b) This question asked candidates to address two parts of a locking and adjusting system. Whilst many were able to give acceptable solutions showing a ratchet and pawl type system for adjustment few could give an adequate lock although there were some part systems involving levers.

(c) Good knowledge of appropriate gears was evident.

(d) There were some good creative solutions which clearly indicated that candidates had addressed all requirements of the design.
There were sound mechanical solutions which clearly reduced effort to press the bearing out of the wheel by applying pressure to the outer ring of the bearing while giving good support to the wheel. Candidates gave good explanations of how they could use their solution to replace the bearing.
Candidates who gave partial solutions were credited with marks where feasible solutions to any part of the problem were given.
Some candidates however revealed that they were not aware of how bearings fit into components and attempted to re-design the bearing.
It is important that candidates carry out product analysis activities on a range of mechanical products in order to help them to understand the relationships between different components in mechanical systems.

1957 / 09 – Internal Assessment

General Comments

It is important that Centres use the correct forms (CSF) for recording internal assessment to allow the moderators to carry out their work. It is pleasing to see a number of Centres giving full details of each objective broken down into 'strands'. This is a very helpful strategy for the student, teacher and moderator.

The vast majority of schools prepared candidates well for this component and the range and nature of projects was impressive. There were some contrasting styles of completing coursework. Some Centres are completing 'GCSE by numbers' that is very prescriptive with no creativity, all students are doing exactly the same project. With such overlap of work differentiation of mark levels is very difficult for Centres to achieve. This year a larger number of candidates had designed and made projects showing high levels of creative thinking

In a large number of Centres a high level of understanding of the requirements for internal assessment was demonstrated. Almost every candidate addressed all the attainment targets. There was some progress towards more concise folders by all Centres, with better selection of relevant material and less 'padding' using theory notes.

The industrial and commercial application within coursework is beginning to be seen in a number of objectives. The commercial thread of manufacturing a prototype or the first of a batch is now embedded in good practice.

Objective 1: Identification of a need or opportunity leading to a Design Brief

It is now well covered by most candidates. Customer/clients are identified and a problem stated. The design brief needs to include the user in the statement

Objective 2: Research into Design Brief leading to a Specification

This section was generally well covered, with most Centres now sure of the format. Research into the problem is still not being completed in detail and more background information is needed. There have been some meaningful surveys completed with information gathered which really informs the specification.

Research into existing projects should take the form of a full product analysis including comments from the user point of view. Products are now being evaluated with some Centres using clear methods or lists. It is important that two products are compared to see the needs of the prototype to be constructed.

It is still important to have a conclusion to all the research to gather all the relevant points together. Some specifications were seen to follow the same format as the product analysis; these produced very detailed constraints for the ideas.

Objective 3: Generation of Ideas

This section must show the systems and control focus. There must be clear Input-Process-Output elements in the proposed solutions. Centres should ensure design proposals are for a complete product including both the system and the case. Too often candidates did not produce a wide range of ideas of both parts, as stated in the specification. The difficulty for moderators is when they are presented with one electronic circuit but a number of cases. At some Centres it

was obvious that a school circuit had been given with candidates making minor changes to suit the need. There was some good use of CAD with more Centres presenting ProDesktop drawings.

Appraisal of the ideas is still variable. In the best examples, the client is considered with a product analysis. The use of scoring systems against the specification gives superficial value judgements and should be avoided. At the end of this section a selection should have taken place with clear details of the elements which are being carried forward for development.

The range of communication techniques is improving with many Centres adding simple rendering to the sketches. Detail work with exploded drawings would help to fully understand the design proposal

Objective 4: Product Development

The experimental nature of this section is now being seen. Models are being constructed to try the concept and layout. The system is being trialled and improvements made. Candidates should record all the development work and not just jump to the final design. The stages and thought processes are important. A number of Centres had supporting evidence of testing with photographs.

Materials should be investigated with choices for the product being based on the need of the solution. Reasons for choice should be stated. Component selection is important in any system, therefore candidates should include any 'catalogue' information in this process. The real choices lie with input and output components which need to match the needs of the prototype.

Control of manufacture and batch production is, in many cases, still covered in a cursory manner. At the worst candidates write about CNC machine tools and then add some theory notes about batches. It is vital that candidates get involved with making templates and jigs. These should be available for the moderator; sketches should show some proposals for the control of manufacturing.
The candidate should use a method of control in making the prototype, then report on its effectiveness in objective 6.

The last part of this section should include the complete working drawings of the systems and the case/structure. If ProDesktop is used, dimensioned drawings are easily achieved directly after the design. Candidates should include all the information for construction.

Objective 5: Production Planning and Realisation

Generally, the better candidates carried out planning to a high order, including processes, tools and equipment, time taken for each stage and risk factors during use of tools. Most Centres now realise the significance of these 12 marks. The use of predictive flow charts of the stages is now the normal way of planning. The use of system process diagrams usually lack detail of actual construction processes.

The next two sections of - 'use of tools, equipment and materials' – 'range of skills and techniques', produced some anomalies. If a final product is of poor quality and not working, high marks cannot be claimed. A similar difficulty occurs when a bought in circuit board is used where candidates only connect wires. The range of techniques available for assessment is very limited.

Many final prototypes are well finished and function as expected. One area of improvement would be in the finer attention to detail. For example heat shrink sleeving (or tubing) could be

used to overcome problems of shorting on component leads. In mechanisms, components could be more accurately drilled to ensure smoother operation.

Objective 6: Evaluation and Testing

There is greater evidence of final evaluations being based upon the use of the specification. The client /customer are now featuring in testing, where a simple survey is being related back to the original need. Most candidates now include comments about resources of materials and construction processes.

Real testing of the function of the product was rarely seen, with proposals for modifications and improvements not completed. The use of the control system needs evaluating from the construction of the prototype before the batch production starts. For most candidates this part of the evaluation was very weak.

Presentation

The organisation of the folder and ordering of the research material has shown an improvement this year. Most Centres are now aware of the overload of large folders and encourage candidates to be more discerning about material included. A number of Centres are now producing pre-printed sheets with headings and borders. This is a step forward and will allow candidates to spend more time on the content of each section.

General Certificate of Secondary Education (D&T) (1957)
June 2005 Assessment Session

Component Threshold Marks

Component	Max Mark	A	B	C	D	E	F	G
01	50			32	27	22	18	14
02	50	32	27	22	17			
03	50			28	24	20	16	12
04	50	27	21	16	10			
05	50			27	21	16	11	6
06	50	36	29	22	15			
07	50			29	24	19	15	11
08	50	28	22	16	10			
09	105	82	70	59	47	35	24	13

Syllabus Options

Foundation Tier Electronics

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175				96	80	64	48	32
Percentage in Grade					24.9	25.2	22	15.7	7.7
Cumulative Percentage in Grade					24.9	50.1	72.1	87.8	95.5

The total entry for the examination was 830

Higher Tier Electronics

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175	136	119	102	86	66	56		
Percentage in Grade		8.7	18.8	30	24.1	14.3	2		
Cumulative Percentage in Grade		8.7	27.5	57.5	81.6	95.9	97.9		

The total entry for the examination was 1252

Foundation Tier Mechanisms

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175				97	80	63	47	31
Percentage in Grade					20.3	28.6	22.1	14.2	8.5
Cumulative Percentage in Grade					20.3	48.9	71.1	85.2	93.7

The total entry for the examination was 634

Higher Tier Mechanisms

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175	136	119	102	86	66	56		
Percentage in Grade		12.6	20.3	28.4	21.8	12.3	2.5		
Cumulative Percentage in Grade		12.6	32.8	61.2	82.9	95.2	97.7		

The total entry for the examination was 948

Foundation Tier Pneumatics

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175				93	76	60	44	28
Percentage in Grade					14.6	21.8	21.8	18.2	12.7
Cumulative Percentage in Grade					14.6	36.4	58.2	76.4	89.1

The total entry for the examination was 57

Higher Tier Pneumatics

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175	137	121	105	90	69	58		
Percentage in Grade		17.9	17.9	35.7	19.1	8.3	0		
Cumulative Percentage in Grade		17.9	35.7	71.4	90.5	98.8	98.8		

The total entry for the examination was 84

Overall

	A*	A	B	C	D	E	F	G
Percentage in Grade	6.5	11.7	17.8	22.8	18.5	10	6	3.2
Cumulative Percentage in Grade	6.5	18.2	36	58.8	77.3	87.3	93.3	96.5

The total entry for the examination was 3805

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