

Design & Technology (Electronic Products)

General Certificate of Secondary Education **GCSE 1953**

General Certificate of Secondary Education (Short Course) **GCSE 1053**

Mark Schemes for the Components

June 2006

1953/1053/MS/R/06

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General Certificate of Secondary Education (Short Course) Electronic Products (1053)

MARK SCHEMES FOR THE COMPONENTS

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**Mark Scheme 1053/01, 1953/01
June 2006**

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

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

[4]

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

[1]

(b) Advantage or solder could include:

- permanent joint
- not easy to accidentally disconnect

1 mark for suitable reason

[1]

Advantage of crimp connector could include:

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

1 mark for suitable reason

[1]

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

[1]

(ii) Stages could include:

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

accept

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

[2]

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

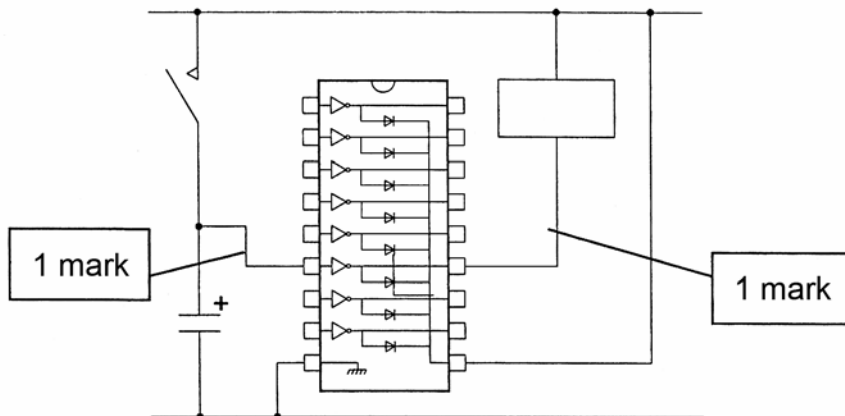
3 (a) (i) Capacitor is for storage of charge while the circuit is operating.
Allow mark for reference to storage. [1]

(ii) Specification points should include reference to:

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

2 x 1 mark for relevant points. [2]

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



(c) (i) Advantages could include:

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

1 mark for suitable advantage. [1]

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

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

[1]

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

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

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

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

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

Total for paper [50]

Mark Scheme 1053/02, 1953/02
June 2006

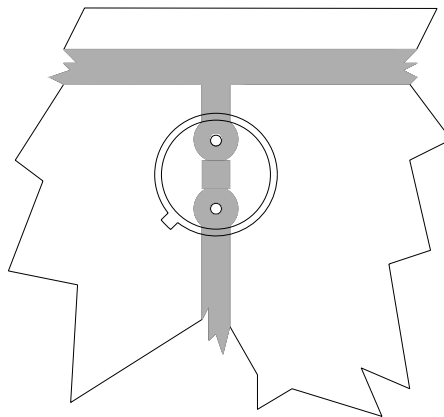
- 1 (a) Benefit of storage:
- can be saved to computer / CD / disc or other media device
 - takes up less space
 - easy to find, recover
 - more can be stored in a controlled way – no stretching of paper or damage to layout
- 1 mark for relevant benefit.
- Benefit of editing:
- easy to alter
 - updating is quick
 - section of circuit can be used in new circuits
- 1 mark for relevant benefit.
- benefit of transport – allow reference to speed
 - can easily be posted on a disc or CD, without damage to drawing
- 1 mark for relevant benefit. [3]
- (b) (i) Moulded lettering has to be included in the cost of tooling, which is very high, once produced it is not possible to change or edit the lettering; [1]
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 - increased use of energy in production
 - increased pollution from distribution / production
 - dangerous components or materials used in the items etc
allow reference to 'throwaway society'
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 - increasing width of tracks
 - leaving less space between components
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 - adding information to copper side
- allow reference to the size of the board
1 mark for relevant response. [1]
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- height of the components is not given by this view
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- 1 mark for missing dimension identified.
1 mark for relevance to the casing design or
2 marks for clear explanation of a single point. [2]

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

- 3 (a) (i) Specification points should refer to –
- temperature range
 - response time
- 2 x 1 marks
no marks for reference to size, diameter or price. [2]

- (ii) 1 mark for reference to –
- horizontal position allowing more even illumination
 - self cleaning with rain
 - North light facing gives even illumination
- [1]

- (iii) 1 mark for drawing of photodiode in position.
The tag must be in correct quadrant of circle for mark to be awarded. [1]

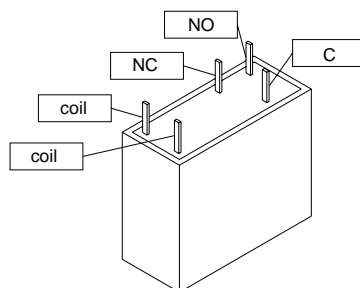


- (b) (i) Purpose of relay is to –
- isolate control circuit from lamp circuit
 - allow a high current device to be controlled by low current
 - allow a high voltage device to be controlled by low voltage
- [1]

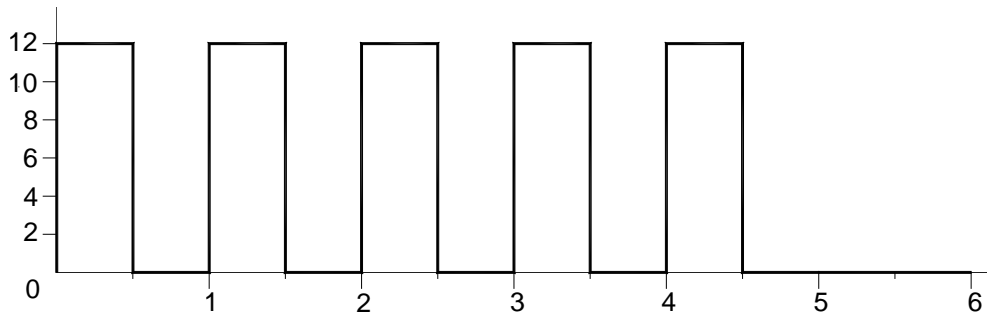
- (ii) Light level just at switching point will cause relay to 'hunt', or switch on and off rapidly. [1]

- (c) (i) $I = W/V$, $I = 300/230$, 1 mark. Answer **1.304A**, accept **1.3A**, (1) [2]

- (ii) Use of correct terms, **NO**, **C**, **coil**, (1)
Correct identification of pins, (1) [2]



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



[2]

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

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

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

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

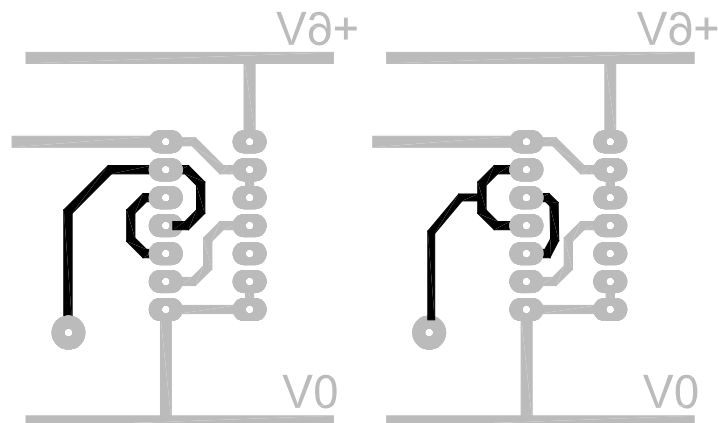
- (c) (i) Calibration is carried out by placing test circuit in a controlled temperature or using an object of correct temperature against the thermistor, (1). the potentiometer is then turned until test LED is just switching on, (1). Allow 2 marks for clear explanation of either part of process. [2]

- (ii) Benefits of PIC microcontroller could include:

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

1 mark for each valid benefit. [2]

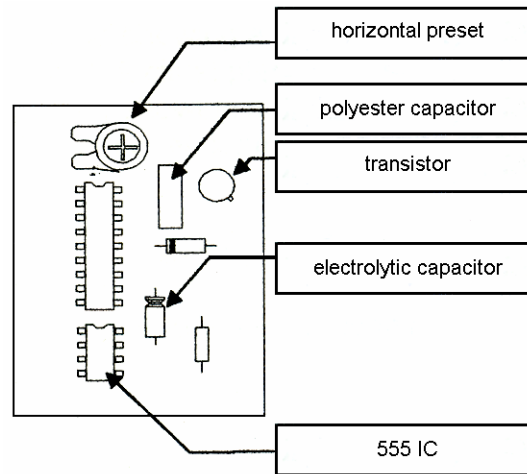
- 5 (a) (i) Suitable sensors could include –
- reed switch
 - proximity sensor
 - optical sensor eg LDR or infra red, (1) [1]
- (ii) Requirement are for fast rise time, (1) no contact bounce, (1)
Allow reference to a clean signal. Amplitude must match CMOS
input 2 x 1 [2]
- (iii) Extra items could include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



Total marks [50]

Mark Scheme 1953/03
June 2006

1 (a)



*Allow any form of understanding. eg. Lines drawn from list.

[4]

(b) Correct tool identified.

Side cutters (accept cutters/wire cutters).

[1]

Long nose pliers/snipe nose pliers (accept pliers).

[1]

(c) (i) Allow any answer showing an understanding of thermal conductivity/corrosion resistance.

[1]

(ii) Copper.

[1]

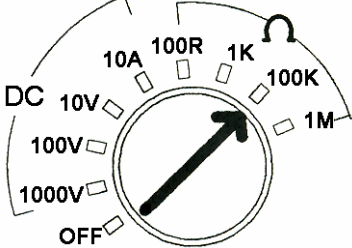
(iii) Allow any answer showing an understanding of thermal insulation or Electrical insulation/comfortable to hold/high visibility. Comfortable to hold/ grip

[1]

(iv) Plastic/rubber (accept wood).

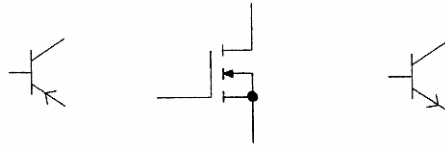
[1]

Total marks [10]

- 2 (a) (i) A drawing showing a digital display. [1]
 A correct reading 5.000 (to at least 1 decimal places). [1]
 A drawing showing an analogue display. [1]
 A correct reading on a 10V f.s.d at centre or pointing to 5V. [1]
- (ii) Easy to see reading/no parallax errors to worry about/robust. [1]
- (iii) No rapidly fluctuating variations. [1]
- (iv)  [1]
 Dial set to 1M resistance range. 1 mark
 Dial set to 100k resistance range. [2]
- (b) (i) Current/amps/5mA. [1]
 (ii) 5V. [1]

Total marks [10]

3 (a)



PNP

FET

NPN

[1]

[1]

[1]

(b) $h_{fe} = \text{collector current/base current}$.

$$h_{fe} = 1.2A/0.015A$$

$$h_{fe} = 80$$

1 mark for correct substitution.

1 mark for correct answer.

2 marks for correct answer without working.

[2]

(c) (i) Reduce electrical noise/interference generated by the motor.

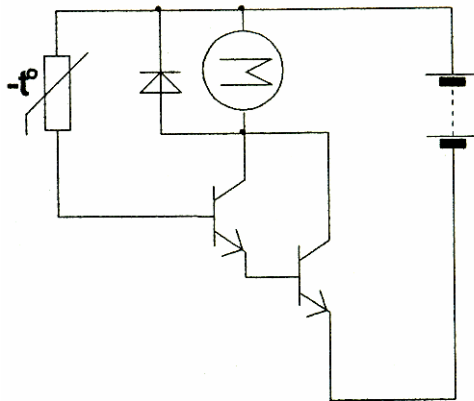
[1]

(ii) The motor would not rotate.
The transistor would get hot/blow, or
the diode would blow
will not work –qualified

[1]

[1]

(d)



1 mark for a correctly connected pair of transistors in a Darlington arrangement.

1 mark for the Darlington Pair correctly placed within the circuit.

[2]

Total marks [10]

- 4 (a) (i) Smaller circuits, easier automated production, lower cost. [1]
- (ii) Trimming protruding leads from underside of PCB's/drilling. [1]
- (b) (i) To electrically connect tracks between upper and underside of the boards. [1]
- (ii) Too small to handle/difficult to keep located when soldering/ difficult to modify prototype. [1]
- (c) (i) Hot air jets. [1]
- (ii) Wave soldering. [1]
- (iii) To prevent components falling off when the board is inverted to pass over the wave. [1]
- (iv) To make the paste sticky/prevent oxide forming/allow solder to flow/clean metal surfaces. [1]
- (d) Difficult to repair/uneconomical to repair/outdated by newer models. 1 mark for each good reason. [2]

Total marks [10]

- 5 (a) Carbon monoxide (CO)/gas/freezer/flooding/falling/fire/smoke.
Any answer showing understanding. [1]
- (b) (i) Ease of installation, less wiring, lower cost. [2]
- (ii) Explanation showing understanding of what scanning is.
That the system will prevent someone scanning/hacking the code. [1]
[1]
- (iii) Explanation showing an understanding that areas can be isolated to be
operated independently. [1]

(c)

Used to detect the presence of smoke	Ionisation chamber
Used to detect whether a door is open or closed	Reed switch
Used to detect a moving body that is emitting heat	PIR
Used to give a flashing visual warning	Xenon strobe
Used to detect a window being broken	Vibration switch

[4]

Total marks [10]

Mark Scheme 1953/04
June 2006

- 1 (a) (i) Smaller circuits, easier automated production, lower cost. [1]
- (ii) Trimming protruding leads from underside of PCB's/drilling. [1]
- (b) (i) To electrically connect tracks between upper and underside of the boards. [1]
- (ii) Too small to handle/difficult to keep located when soldering/ difficult to modify prototype. [1]
- (c) (i) Hot air jets. [1]
- (ii) Wave soldering. [1]
- (iii) To prevent components falling off when the board is inverted to pass over the wave. [1]
- (iv) To make the paste sticky/prevent oxide forming/allow solder to flow/clean metal surfaces. [1]
- (d) Difficult to repair/uneconomical to repair/outdated by newer models. [2]
1 mark for each good reason.

Total marks [10]

- 2 (a) Carbon monoxide (CO)/gas/freezer/flooding/falling/fire/smoke.
Any answer showing understanding. [1]
- (b) (i) Ease of installation, less wiring, lower cost. [2]
- (ii) Explanation showing understanding of what scanning is. [1]
That the system will prevent someone scanning/hacking the code. [1]
- (iii) Explanation showing an understanding that areas can be isolated to be operated independently. [1]

(c)

ect the presence of smoke	tion chamber
ect whether a door is open or closed	ed switch
ect a moving body that is emitting heat	PIR
a flashing visual warning	non strobe
ect a window being broken	ation switch

[4]

Total marks [10]

3	(a)	(i)	$P=V*I$ $P=10V*3.33A$ $P=33W/33.33W$ (units not required)	[1]
		(ii)	Correct substitution into formula i.e. $I_b=I_c/hfe$, $I_b=1.25A/80$ 1 Correct answer $I_b=0.015625A/15.6mA$ 1	[2]
		(iii)	Calculating the voltage across the resistor. $V=I*R$ Correct answer $V=1.25A*3R3 = 4.125V$ 1 Subtracting resistor voltage from supply voltage. $10V-4.125V$ 1	[2]
			* Correct answer without working 5.875V merits full 2 Marks	[2]
	(b)	Transistor does not dissipate heat. The arrangement is energy efficient/wastes less power.	1 1	[2]
	(c)	Drawing presenting a realistic solution. Copper/aluminium or other suitable metal identified. Nut & bolt/clip or other suitable fastening.	1 1 1	[3]
Total marks [10]				

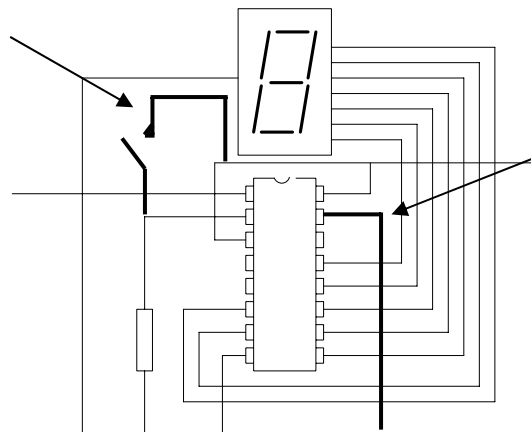
4 (a)

No	Segments
1	b c
2	a b e d g
3	a b c d g
4	b c f g
5	a c d f g
6	a c d e f g
7	a b c
8	a b c d e f g
9	a b c f g

[2]

(b) Will operate over a wide range of supply voltages./ Consumes less current during operation. [1]

(c) (ii) PTM Switch correctly drawn and positioned 1 Mark



(i) Link made between 15V and 0V line 1 Mark

[2]

(iii) To save power when the display is not being used/to control brightness using M:S control/to blank zero display. [1]

(d) (i) Common cathode display. [1]

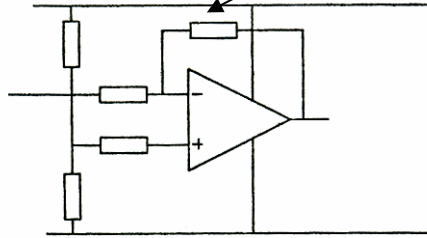
(ii) Because the 4026 outputs high and 'sources' the led segments [1]

(e) Square waveform correctly drawn 1 Mark.
Rising edge correctly identified/explained 1 Mark. [2]

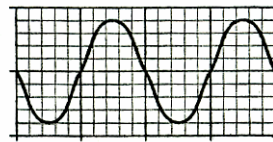
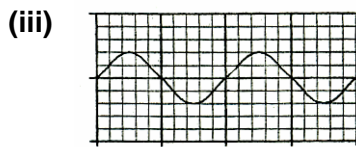
Total marks [10]

5 (a) (i)

Resistor drawn in correct position between Inv. i/p and o/p. [1]

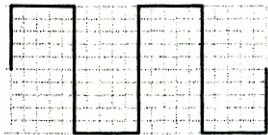
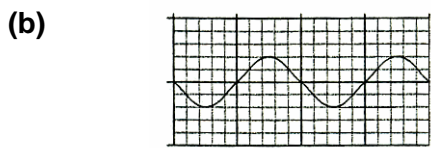


(ii) $R_f = R_{in} \times \text{gain}$ 1 Mark for correct substitution into formula, or correct answer
 $R_f = 10k \times 10$
 $= 100k (100,000)$ [1]



Waveform drawn inverted and of correct wavelength 1 Mark
 Waveform drawn at correct amplitude ie. +8V/-8V peak 1 Mark

[2]



Inverted square waveform of correct wavelength 1 Mark
 Full amplitude 1 Mark.

[2]

(c) (i) Has on board: RAM
 Has on board: Interfaced i/p's and o/p's. [2]
 Other relevant point

(ii) To provide an accurate clock/vibration/oscillation 1 Mark.
 Needed to provide steps for the program. 1 Mark. [2]

Total marks [10]

**General Certificate of Secondary Education (D & T) (1053)
June 2006 Assessment Series**

Component Threshold Marks

Component	Max Mark	A	B	C	D	E	F	G
01	50	-	-	28	24	20	17	14
02	50	29	24	19	14	-	-	-
03	105	81	69	58	47	36	25	14

Syllabus Options

Foundation Tier

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175	-	-	-	88	75	62	49	36
Percentage in Grade		-	-	-	28.1	18.8	25.0	15.6	12.5
Cumulative Percentage in Grade		-	-	-	28.1	46.9	71.9	87.5	100

The total entry for the examination was 59

Higher Tier

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175	135	118	101	85	67	58	-	-
Percentage in Grade		12.2	22.5	38.8	14.3	12.2	0.0	-	-
Cumulative Percentage in Grade		12.2	34.7	73.5	87.8	100	100		

The total entry for the examination was 54

Overall

	A*	A	B	C	D	E	F	G
Percentage in Grade	7.4	13.6	23.4	19.8	14.8	9.9	6.2	4.9
Cumulative Percentage in Grade	7.4	21.0	44.4	64.2	79.0	88.9	95.1	100

The total entry for the examination was 113

**General Certificate of Secondary Education (D & T) (1953)
June 2006 Assessment Series**

Component Threshold Marks

Component	Max Mark	A	B	C	D	E	F	G
01	50	-	-	28	24	20	17	14
02	50	29	24	19	14	-	-	-
03	50	-	-	22	19	16	14	12
04	50	25	20	15	10	-	-	-
05	105	81	69	58	47	36	25	14

Syllabus Options

Foundation Tier

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175	-	-	-	91	76	61	47	33
Percentage in Grade		-	-	-	27.6	23.2	20.8	15.3	9.0
Cumulative Percentage in Grade		-	-	-	27.7	50.8	71.6	86.9	95.9

The total entry for the examination was 2363

Higher Tier

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175	132	115	98	82	64	55	-	-
Percentage in Grade		11.2	22.7	32.2	21.9	9.1	1.5	-	-
Cumulative Percentage in Grade		11.2	33.9	66.2	88.1	97.2	98.7		

The total entry for the examination was 2610

Overall

	A*	A	B	C	D	E	F	G
Percentage in Grade	6.2	12.4	17.7	24.5	15.5	10.2	6.9	4.0
Cumulative Percentage in Grade	6.2	18.6	36.3	60.8	76.3	86.5	93.4	97.4

The total entry for the examination was 4973

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

OCR Information Bureau

(General Qualifications)

Telephone: 01223 553998

Facsimile: 01223 552627

Email: helpdesk@ocr.org.uk

www.ocr.org.uk

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