General Certificate of Secondary Education

Design and Technology: Electronic Products

Specimen Mark Scheme

The Specimen assessment materials are provided to give centres a reasonable idea of the general shape and character of the planned question papers and mark schemes in advance of the first operational exams.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Section A

Question 1

(a)	Two relevant advantages provided by candidate	2 marks	
	One relevant advantage given	1 mark	
	Advantages must relate to the battery selected, e.g. • Small size • High current / power • Alkaline • Long life		
	Candidates give an incorrect response	0 marks	*(2 marks)*
(b)	B or red	1 mark	
	Colour – red for rear light	1 mark	
	Any other irrelevant response	0 marks	*(2 marks)*
(c)	Astable or pulse generator or 555 IC PIC	1 mark 1 mark	
	(Also accept additional Astable using Logic gates or dedicated IC or other method)		
	Any other irrelevant response	0 marks	*(2 marks)*
(d)	LDR or Light Dependant Resistor	1 mark	
	(Do not accept Light Sensor)		
	Any other irrelevant response	0 marks	*(1 mark)*
(e)	Resistance changes with light level or Resistance increases as light level decreases or Resistance decreases as light level increases	1 mark 2 marks 2 marks	
	Any other irrelevant response	0 marks	*(2 marks)*
(f)	Op- Amp or Operational Amplifier Microcontroller or PIC	1 mark 1 mark	
	(Also accept 555 Monostable and Analogue to Digital convertor such as LM3914)		
	Any other irrelevant response	0 marks	*(2 marks)*

Question 2

	Generic material e.g. plastic or Specific material e.g. HIPS, Acrylic	1 mark or 2 marks	
	If wood or metal are suggested	0 marks	*(2 marks)*
	Four LEDs shown in the design	1 mark	
	LEDs in an appropriate position, central to container and away from the edges	1 mark	
	Any other irrelevant response	0 marks	*(2 marks)*
	Interference fit in container or Secure method to hold LEDs in place, e.g. bezel, clip (Glue or tape not accepted for 2nd mark)	1 mark or 2 marks	
	Any other irrelevant response	0 marks	*(2 marks)*
	On / Off switch in accessible and protected position	1 mark	
	Any other irrelevant response	0 marks	*(1 mark)*
	Method of access to case indicated	1 mark	
	Appropriate size of access to allow circuit maintenance and battery change	2 marks	
	Any other irrelevant response	0 marks	*(2 marks)*
	Three dimensions shown clearly Units are mm (millimetres) Appropriate size for the case – none greater than 150mm	1 mark 1 mark 1 mark	
	Any other irrelevant response	0 marks	*(3 marks)*
	Method of attaching to bike shown Method would hold securely How the case accommodates the fixing method Match between method and position	1 mark 1 mark 1 mark 1 mark	
	Any other irrelevant response	0 marks	*(4 marks)*
QoC	Well presented with detailed drawing(s) and annotation	3 marks	
	Limited detail in the drawings with annotation or clear drawings with simple annotation	2 marks	

Unclear drawings with very basic annotation	1 mark	
Unrecognisable as a possible design	0 marks	*(3 marks)*

Section B

Question 3

(a)		**Only acceptable answers.**		
	A	LED / Light Emitting Diode	1 mark	
	B	Resistor / Fixed Resistor	1 mark	
	C	Potentiometer / Variable Resistor	1 mark	
	D	LDR / Light Dependant Resistor	1 mark	
	E	Integrated Circuit / IC / DIL package	1 mark	
		Not		
		Chip / 555 / 741 / Microcontroller / PIC		
		Any other irrelevant response	0 marks	*(5 marks)*
(b)		**Only correct answers – any other response**	0 marks	
	(i)	LED or Light Emitting Diode	1 mark	
	(ii)	Thermistor	1 mark	
	(iii)	PTB switch or Push to Break switch	1 mark	
	(iv)	Thyristor	1 mark	
(c)		Polymorph	1 mark	
				(5 marks)

Question 4

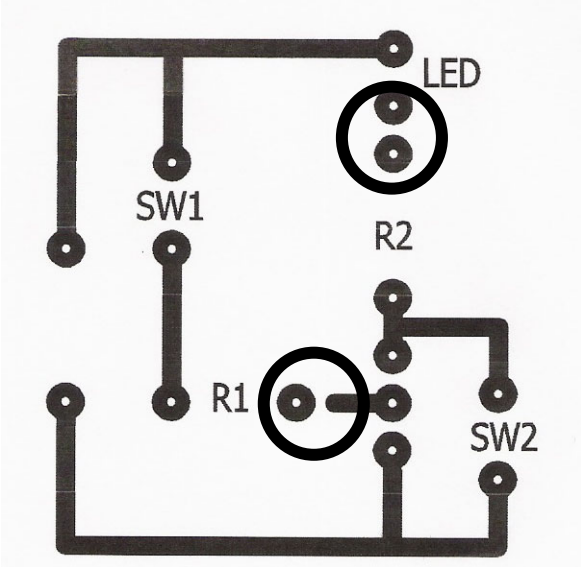
Stages:	QC points	H&S points
1. produce artwork	Tracks correct width Pads sufficient size Image dense enough	none
2. Place photo-sensitive board on UV unit	Orientation is correct Material correctly positioned	
3. Expose to UV light for predetermined period	Correct exposure time	Protect eyes
4. Develop	Correct development time Under or over development will affect subsequent stages	Protect eyes Protective clothing including gloves
5. Wash	Must be clean of contaminants before next stage	
6. Etch	Etch for sufficient time to ensure cleanly etched boards.	Protect eyes Protective clothing including gloves
7. Wash	Must be clean of contaminants before next stage	
8. Dry	Dried thoroughly to avoid copper surface corroding	Avoid burns if heat used
9. Check	All salient points e.g. tack widths, continuity, no parts missed etc.	

Candidate has identified most or all of the stages required to make the correct board. Most stages have been correctly sequenced and candidate may have identified additional appropriate stages. Candidate has described and evaluated most of the QC and H&S issues identified above. Response is well structured with good use of appropriate terminology and shows a good grasp of grammar, punctuation and spelling.	8 - 10 marks
Candidate has identified some of the stages required to make the correct board. Some stages have been correctly sequenced and candidate may have identified additional appropriate stages. Some evaluation of the relevant QC and H&S issues has been made.	

Response is fairly well structured with some use of appropriate terminology and with only a small number of errors in grammar, punctuation and spelling.	5 – 7 marks	
Candidate has identified few of the stages required to make the correct board. Few stages have been correctly sequenced. Little consideration has been given to the evaluation of QC and H&S issues. Response is structured poorly with little or no use of relevant terminology and with numerous errors in grammar, punctuation and spelling.	1 – 4 marks	
Candidate has given statements not related to the process.	0 marks	*(10 marks)*

Question 5

(a)	(i)	LED lights	1 mark	
		Thyristor latches on / mention of Thyristor gate voltage	1 mark	
		Any other irrelevant response	0 marks	*(2 marks)*
	(ii)	LED stays on until released	1 mark	
		Thyristor resets / Thyristor shorted out	1 mark	
		Any other irrelevant response	0 marks	*(2 marks)*
(b)		Circle or other clear indication on the missing track	1 mark	
		Circle or other clear indication on the incomplete track	1 mark	
		Incorrect indication elsewhere	0 marks	*(2 marks)*



(c) Evaluation by comparison

CAD method one mark for each point made by comparison or a clearly described advantage.

More accurate than hand drawing – 1 mark

Possible to populate PCB with virtual components – this not possible with stripboard where real components need to be obtained 1 mark

If the evaluation goes further e.g. which makes it a faster method, or easier to change components 1 additional mark.

Circuit can be simulated to check on performance without needing to worry about mechanical connections. 1mark

This means it is more reliable as often prototype boards have faults 1 additional mark

Easy to change a CAD produced circuit, manual methods often have to be started again 1 mark

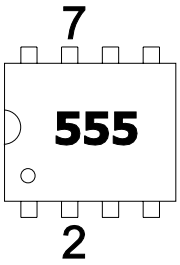
If then continued to suggest this increases development time of even frustrates the person doing it 1 additional mark

Maximum 5 marks available

(5 marks)

Question 6

(a)



			1 mark for each	
		Incorrect labelling	0 marks	*(2 marks)*
(b)	(i)	Pin 6 & 7 joined together	1 mark	
		Fixed resistor between 6 & 7 and the 9V line	1 mark	
		Capacitor between 6 & 7 and the 0V line	1 mark	
		Wrong connection	0 marks	*(3 marks)*
	(ii)	Fixed resistor between pin 2 and 9V line	1 mark	
		Labelled 10K or greater	1 mark	
		Correct symbol for PTM switch	1 mark	
		Connected between Pin 2 and 0V line	1 mark	
		Answers not related to the question	0 marks	*(4 marks)*
	(iii)	Transistor or Darlington Pair base connected to pin 3	1 mark	
		Emitter to 0V	1 mark	
		Lamp connected between collector and 9V	1 mark	
		(Or correct connections for using a FET)		
		Answers not related to the question	0 marks	*(3 marks)*
QoC		Connections are clear straight lines	1 mark	
		Correct symbols in proportion	1 mark	
		Answers not related to the question	0 marks	*(2 marks)*
(c)	(i)	Correctly identified transducer.	1 mark	
	(ii)	Correct alternative given Examples: FET, Darlington, Bi-polar transistor with sufficient capacity	1 mark	
		Answers not related to the question	0 marks	*(2 marks)*

(iii) Typical advantages;

- Increased current carrying capacity
- Increased gain

Candidates may refer to devices not operating
e.g. not enough current can pass
May qualify these remarks, eg by explaining why light may be dim.

Candidate provides explanation of how circuit performance is improved and also considers what happens if these devices are not used.	3 marks	
Some consideration given to the improvements although candidate may not refer to what happens if devices are not used.	2 marks	
Limited response with minimal reference to improvements.	1 mark	
No relevant response	0 marks	

(d)	Formula – T = R x C Incorrect formula	1 mark 0 marks	*(3 marks)*
	T = 470K x 100□F or T = 0.47 x 100s or T = 470 x 100 / 1000s	1 mark	
	T = 47s	1 mark for answer 1 mark for units	*(4 marks)*

Question 7

(a) Marks to be awarded for reference to these points:

• How long the product is expected to last	1 mark	
• How long it will be manufactured	1 mark	
• How long it will be available for sale / purchase	1 mark	*(3 marks)*
Incorrect statements	0 marks	

(b) Examples of possible responses which could be included:

- Encouraged to replace before obsolete / ”throw away society”
- Advertising creates “must have” society
- Greater cost of new products
- Limited available resources
- Resources have to be taken from different areas Increased cost of transport
- Fossil fuels
- Global warming

Response is well structured with good use of the examples above and shows a good grasp of grammar, punctuation and spelling.	5 – 6 marks	
Response is fairly well structured with some use of the examples above and with a small number of errors in grammar, punctuation and spelling.	3 - 4 marks	
Response is structured poorly with little or no use of the examples above and with numerous errors in grammar, punctuation and spelling.	1 – 2 marks	
Response not related to the consumer or to the environment	0 marks	*(6 marks)*

Question 8

(a)	(i)	Fixed resistor between pin 2 and 9V line	1 mark	
		Fixed resistor between pin 2 and 0V line	1 mark	
		Resistors marked as equal values	1 mark	
		Value greater than 10K	1 mark	
		Answers not related to the question	0 marks	*(4 marks)*
	(ii)	Symbol for Thermistor	1 mark	
		Thermistor connected between pin 3 and 0V line	1 mark	
		Potentiometer connected between pin 3 and 9V line	1 mark	
		Fixed resistor in series with potentiometer to prevent resistance going to zero	1 mark	
		Answers not related to the question	0 marks	*(4 marks)*
(b)		Formula – Vout = Vs x R2 / (R1+R2)	1 mark	
		Working – Vout = 9 x 15 / (15+5) = 135/20	1 mark	
		Answer with units – Vout = 6.75V	1 mark for answer	
		V or Volts	1 mark for units	
		Answers not related to the question	0 marks	*(4 marks)*

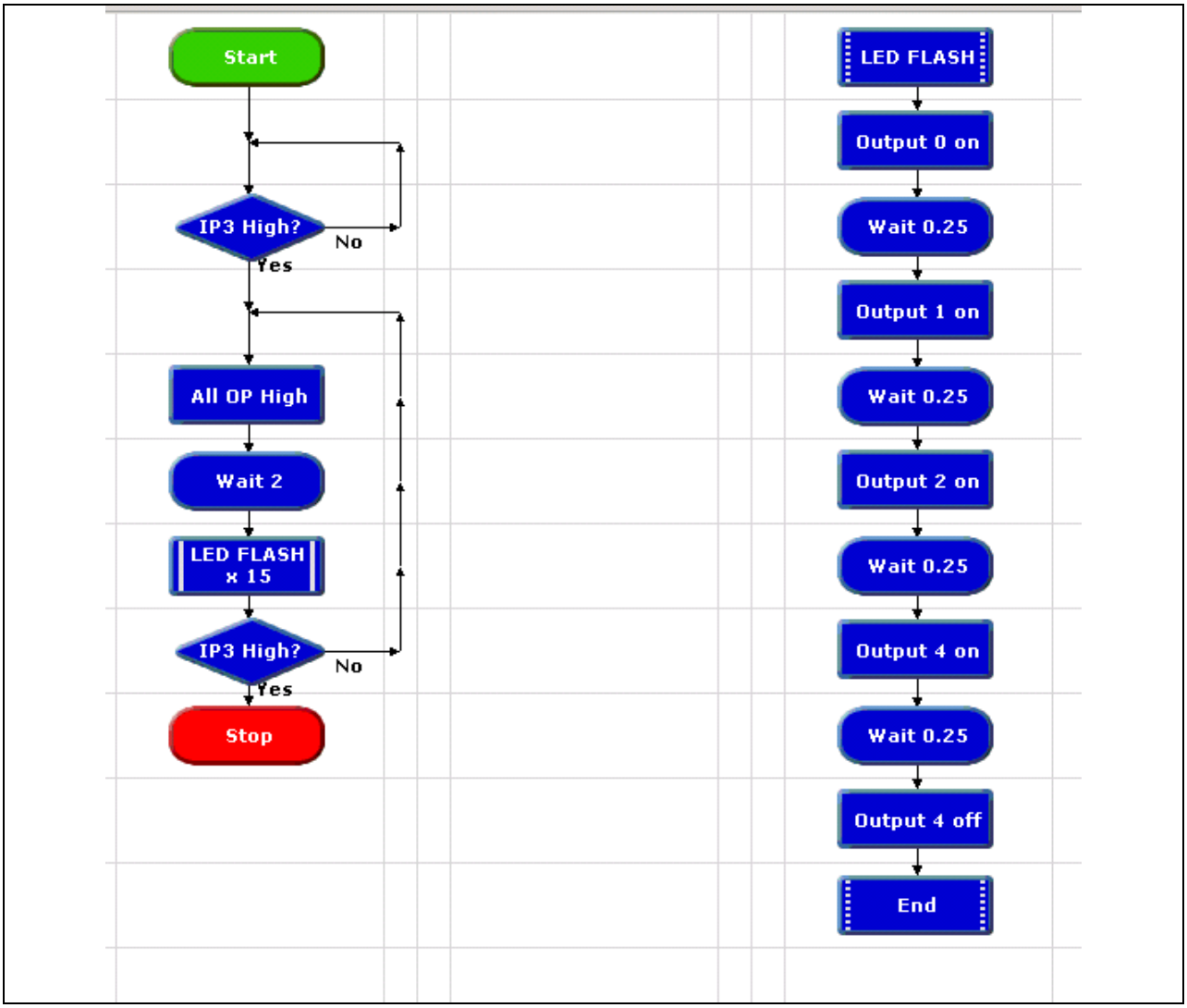
Question 9

The question can be answered using any programming system available in schools. The mark scheme is therefore generic.

Check for Input 3 high	1 mark	
All outputs on	1 mark	
Wait for 2 seconds.	1 mark	
All outputs off	1 mark	
Subroutine/Macro/Procedure called	1 mark	
Repeats 15 times	1 mark	
Output 0 on	1 mark	
Wait 0.25s	1 mark	
Output 0 off; output 1 on	1 mark	
Wait 0.25s	1 mark	
Output 1 off; output 2 on	1 mark	
Wait 0.25s	1 mark	
Output 2 off; output 4 on	1 mark	
Wait 0.25s, Output 4 off;	1 mark	
Check Input 3 return to all outputs on	1 mark	
Answers not related to the question	0 marks	*(15 marks)*

Total 120 marks

Flow chart example for question 10



Additional Sample Question Mark Scheme

No relevant or correct response	0 marks
Limited reference, e.g. size of components or products	1 mark
Detailed reference e.g. reduced size/miniturisation of processing components	2 marks
Relevant comments about likely impacts, examples are: More efficient products Smaller products New products constantly been produced Feel need to get latest product – must have Less power required – therefore smaller batteries	
Full response giving detail about several of the impacts upon society	3 marks
Response gives some of the impact upon society	2 marks
Limited response with one or two bulleted points	1 mark

(5 marks)

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