General Certificate of Secondary Education
June 2012

Electronics   **44301**

(Specification 4430)

Unit 1: Written Paper

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' 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.

Question	Part	Subpart	Marking guidance		Mark
1	(a)		1 switch off/remove from supply✓ 2 first aid✓ 3 get help✓		**3**
1	(b)		(order of effects is not important) Shock✓ paralysis/heart stops/breathing stops✓ Burn✓ excess heat delivered to point of contact✓		**4**
1	(c)	(i)	I = W/V, 1000/230✓ = 4.35A✓		**2**
1	(c)	(ii)	5A✓(or ecf) Be prepared to accept 10A. 5A fuse will fail at switch on, eventually.		**1**
2	(a)	(i)	contact sensor or pressure sensor✓		**1**
2	(a)	(ii)	audible warning device✓		**1**
2	(a)	(iii)	latch✓		**1**
2	(b)	(i)	latch✓		**1**
2	(b)	(ii)	comparator✓		**1**
2	(b)	(iii)	awd✓		**1**
2	(c)	(i)	OR gate✓		**1**
2	(c)	(ii)	comparator✓		**1**
2	(d)		description of system operation✓✓		**2**

3	(a)	(i)	Beam of light, LED, lamp, laser etc ✓		**1**

3	(a)	(ii)	LDR✓		**1**

3	(a)	(iii)	will be broken by box flaps when up✓		**1**

3	(b)	(i)	AND gate✓		**1**

3	(b)	(ii)	**(**ecf possible) weight sensor✓ ——— flap sensor✓ ——— (AND gate ✓) —— stapler✓		**4**

3	(b)	(iii)	(ecf possible)		**2**

Weight sensor	Flap sensor	Stapler	
0	0	0	
0	1	0	✓
1	0	0	
1	1	1	✓

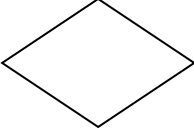| 4	(a)	(i)			5

4	(a)	(ii)	$T = (R_1 + 2R_2)C/1.44$✓ $= 2.01 \times 10^5 \times 10^{-8}/1.44$✓ $= 0.0014s$ or $1.4ms$✓		3

4	(b)		D-type flip-flop✓ 		2

4	(c)	(i)	PIC chip/microcontroller✓		1

4	(c)	(ii)	only one IC needed/cheaper/reprogrammable✓		**1**

5	(a)	(i)	MOSFET✓		**1**

5	(a)	(ii)	drain✓ gate✓ source✓ down the diagram		**3**

5	(a)	(iii)	diode symbol correct✓ across the motor✓ in reverse bias✓		**3**

5	(b)	(i)	12/6✓ = 2Ω✓		**2**

5	(b)	(ii)	min 12A✓		**1**

6	(a)		start ✓ display "touch screen ✓ input screen sensor ✓ has "finish" been pressed? ✓ calculate total bill ✓		**5**

| 6 | (b) | | decision box ✓

 Input box ✓

 a loop is any line that returns to a point earlier in the flow chart ✓

 output box ✓

 process box ✓ | | **5** |

6	(c)	For example		8 Max

For example

calculate total bill

↓

display "pay by card or cash?

↓

input card and cash buttons

↓

which button is pressed?

input cash

↓

calculate change

↓

output change and receipt

input card

↓

debit card

↓

issue receipt

return to under start

max 8 marks
✓✓✓✓✓✓✓✓

7	(a)	aerial✓ demodulator✓ accept detector.		2

7	(b)		to separate/select✓ one signal/frequency ✓ (from all the others)		**2**

7	(c)		20-50 Hz✓		**1**

7	(d)	(i)	frequency modulation✓		**1**

7	(d)	(ii)	amplitude modulation✓		**1**

7	(d)	(iii)	Amplitude modulated wave✓ in phase with audio signal✓ Frequency modulated signal✓ in phase with audio signal✓		**4**

7	(e)	(i)	the ability to pick up/detect✓weak signals✓		**2**

7	(e)	(ii)	the ability to select one frequency✓and reject all the others/from all the others✓		**2**

8	(a)				**3**

test switch	light sensor	temp. sensor	X	Y	buzzer
			1	0	0
			0	0	0
			1	1	1
			0	0	0
			1	0	1
			0	0	1
			1	1	1
			0	0	1
			✓	✓	✓

8	(b)	(i)			1

A	B	Q
		1
		0
		0
		0
		✓

8	(b)	(ii)			4

test switch	temp. sensor	light sensor	P	R	S	buzzer
			1	0	1	0
			0	1	0	1
			1	0	1	0
			0	0	1	0
			1	0	0	1
			0	1	0	1
			1	0	0	1
			0	0	0	1
			✓	✓	✓	✓

8	(b)	(iii)	only needs one chip✓ so cheaper/NOR gates cheaper✓ less power consumption✓ (2 max)		2 Max

8	(c)	(i)	2 V✓✓		2

8	(c)	(ii)	30 kΩ ✓		1

8	(c)	(iii)	15 kΩ ✓✓		2

8	(d)				6
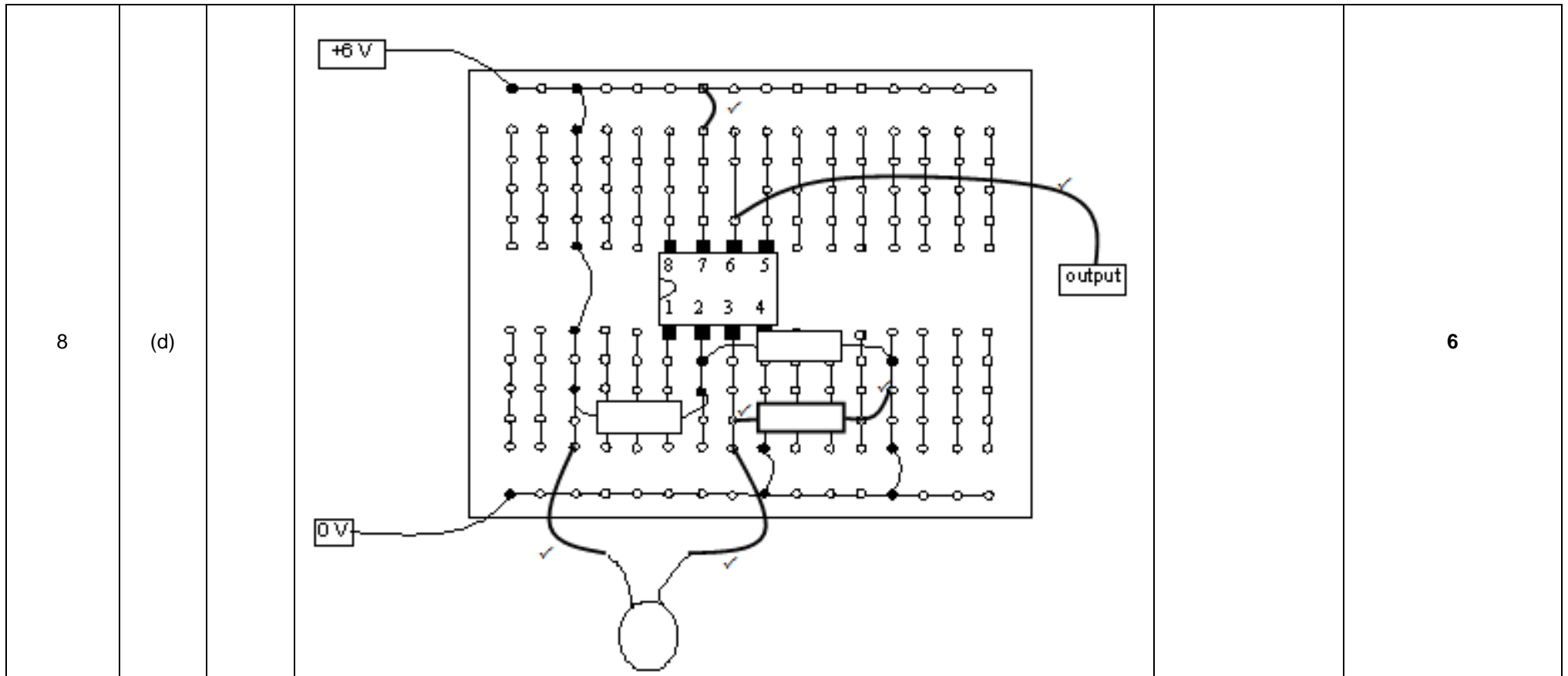
9	(a)		output✓ inverting input✓ non-inverting input✓ power supply✓		4

9	(b)	(i)	Positive battery to positive on amplifier✓ Negative battery to 0 V✓ Ammeter in series✓ Voltmeter in parallel✓		4

9	(b)	(ii)	1.1(056) ✓W✓		2

9	(b)	(iii)	Meter "wrong" way round/current flowing other way✓ not necessary to change round (but may be desirable)✓		**2**
9	(c)	(i)	4 × 5✓ = 20 ms✓		**2**
9	(c)	(ii)	F = 1/T✓ = 50 Hz✓		**2**
9	(c)	(iii)	2 × 0.1✓ = 0.2 V ✓		**2**
9	(c)	(iv)	20 × 0.2✓ = 4 V ✓		**2**
9	(c)	(v)	amplitude 4 divisions✓recognisable sine wave✓ same frequency as c) i) ✓ accept either phase		**3**
9	(c)	(vi)	4 ÷ 1.4(14) ✓ = 2.8 V✓		**2**

10	(a)	(i)			4
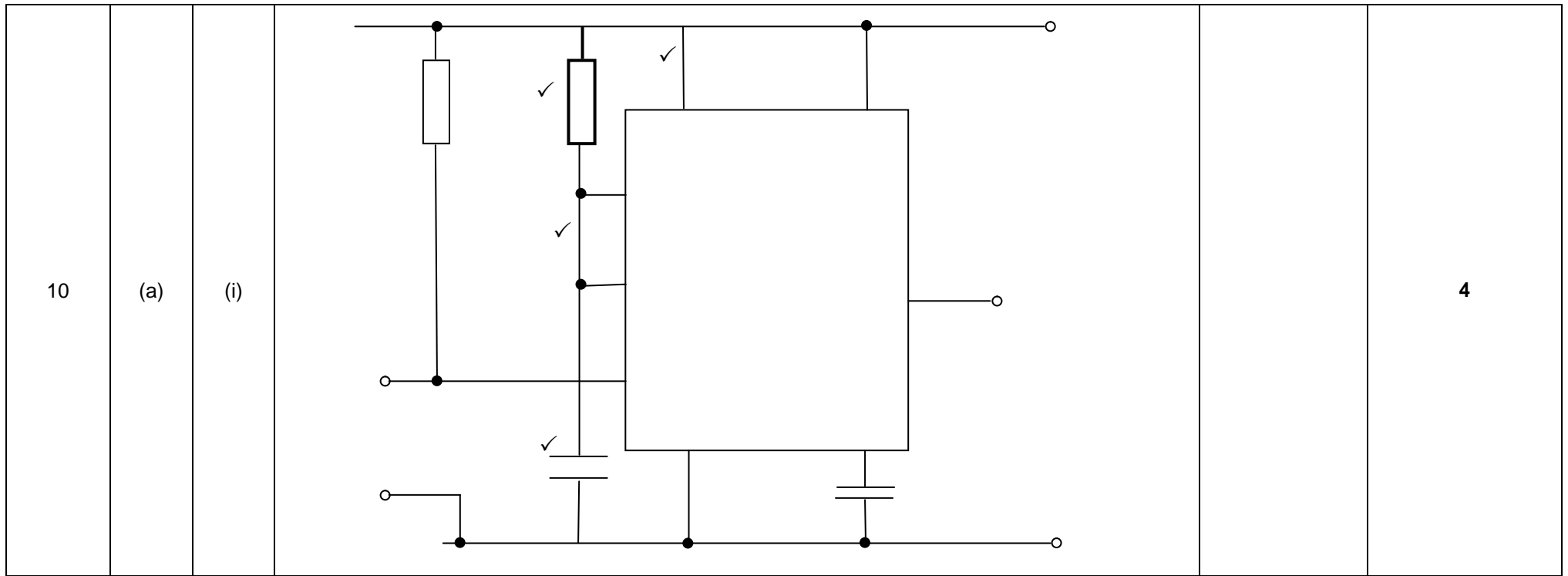
10	(a)	(ii)	R holds voltage high until ring touches✓ Voltage falls (to zero) ✓ Monostable produces pulse of fixed length✓ Pulse length determined by timing R and C✓		3 Max

10	(b)	(i)	LED symbol connected to Q_0✓ Appropriate resistor✓		2

10	(b)	(ii)	LEDs light✓one after the other/in turn✓		2

| 10 | (b) | (iii) | The marking scheme for this part of the question includes an assessment of the Quality of Written Communication (QWC). There are no discrete marks for the assessment of written communication but QWC will be one of the criteria used to assign the answer to an appropriate level below.

Level 3 Marks 4-5
An answer will be expected to meet most of the criteria in the level descriptor.
• Answer is full and detailed and is supported by an appropriate range of relevant points such as those given below
• Argument is well structured with minimal repetition or irrelevant points
• Accurate and clear expression of ideas with only minor errors in the use of technical terms, spelling, punctuation and grammar

Level 2 Marks 2-3
An answer has some omissions but is generally supported by some of the relevant points below.
• The argument shows some attempt at structure
• The ideas are expressed with reasonable clarity but with a few errors in the use of technical terms spelling, punctuation and grammar

Level 1 Marks 0-1
Answer is largely incomplete; it may contain some valid points which are not clearly linked to an argument structure.
• Unstructured answer
• Errors in the use of technical terms, spelling, punctuation and grammar or lack of fluency

An example of the type of answer that may be produced would be:

Counting only happens when CE is low. After resetting the counter CE is low until the ring touches the wire for the sixth time. On the sixth pulse Q_6 goes high. Connecting Q_6 to CE will stop the counter on the sixth pulse. The buzzer will continue to sound even if the ring touches the wire again. Without this connection the seventh touch would stop the buzzer. The100kΩ resistor ensures that CE is low unless Q_6 is high; it is a pull down resistor. | | **5** |

| 10 | (b) | (iv) | blue,grey✓ brown✓ gold✓ | | **3** |