Version 1.0

General Certificate of Education (A-level)
June 2012

Electronics ELEC1

(Specification 2430)

Unit 1: Introductory Electronics

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.

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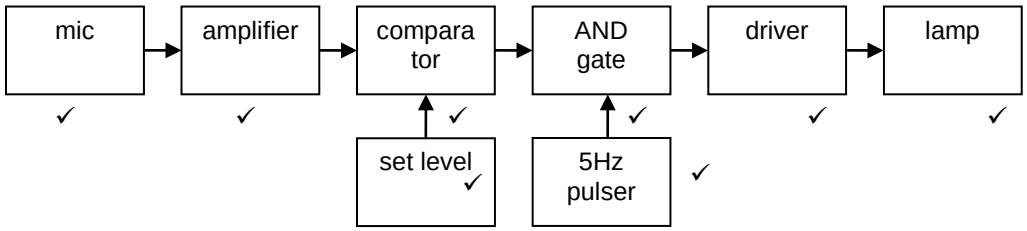
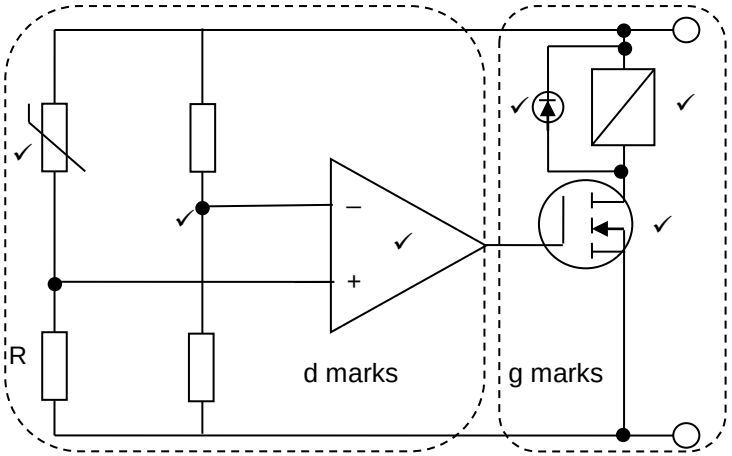
Question	Part	Sub	Marking guidance		Mark
1	(a)		<table><tr><th>A</th><th>B</th><th>C</th><th>D</th><th>Q</th></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td></tr></table> ✓ ✓ ✓		**3**
1	(b)		C = $\overline{A.B}$✓ D = $\overline{A+B}$✓ Q = $\overline{A.B}$. ✓ (A + B) ✓		**4**
1	(c)		EXOR✓		**1**
2	(a)				**8**
2	(b)	(i)	amplifier ✓ comparator ✓		**2**
2	(b)	(ii)	set level✓		**1**
2	(b)	(iii)	driver✓		**1**
3	(a)	(i)	$I^2 = P/R = 0.1/100$✓ leading to I =32mA✓		**2**

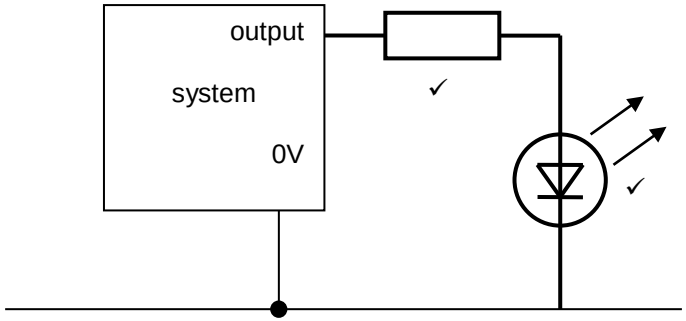
3	(a)	(ii)	R = V/I = 12/0.032✓ = 375Ω✓ (31.6mA 379 Ω) allow		**2**
3	(a)	(iii)	375 – 100 = 275✓, choose 300Ω ✓		**2**
3	(b)	(i)	(300/10300) x 12✓ = 0.35V✓		**2**
3	(b)	(ii)	(300/100300) x 12 = 0.036V✓		**1**
3	(c)		too low/ very little difference✓		**1**
3	(d)		increase it✓		**1**
3	(e)		reduce current drawn and increase battery life ✓		**1**
4	(a)		thermistor, or other means✓ (in pot div circuit) ✓		**2**
4	(b)		comparator✓		**1**
4	(c)		When V_{inv} exceeds $V_{non\text{-}inv}$, o/p goes low ✓ When $V_{non\text{-}inv}$ exceeds V_{inv}, o/p goes high ✓		**2**

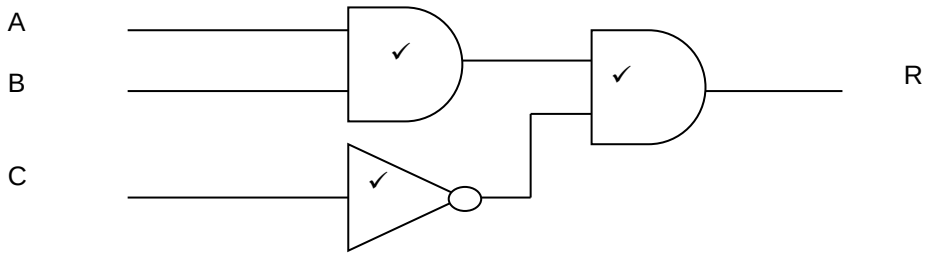
4	(d)	(& g)	eg (other versions are possible)  		**6**

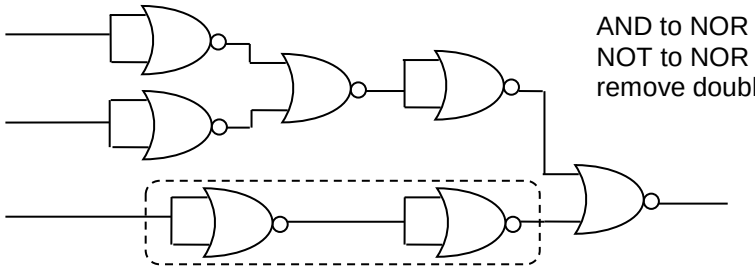
4	(e)		negative saturation of output stage✓		**1**

4	(f)		op-amp cannot supply enough current for a solenoid, a MOSFET can✓ MOSFETs generally require a few volts on gate to turn on, so not reacting to the saturation output of op-amp✓		**2**

4	(g)		See 4(d)		**See 4(d)**

5	(a)		 		**2**

5	(b)	(i)	12 – 2 = 10V✓ 10/0.025 = 400Ω ✓		**2**
5	(b)	(ii)	10 x 0.025✓ = 0.25W✓		**2**
5	(b)	(iii)	430 Ω (allow 470 Ω) ✓		**1**
5	(b)	(iv)	yellow orange✓ brown gold✓ or ecf		**2**
6	(a)	(i)	9V / >4.5V / high voltage✓		**1**
6	(a)	(ii)	resistor in series with switch from 0V✓ switch between 9V and output✓		**2**
6	(b)		L = A.B.C (or A.C) ✓ R = A.B.$\overline{C}$✓ S = A.$\overline{B}$.$\overline{C}$✓ (or A.$\overline{B}$) (allow)		**3**
6	(c)				**3**

6	(d)		 AND to NOR conv✓ NOT to NOR conv✓ remove double inv✓		**3**