OCR
Oxford Cambridge and RSA

GCE

Electronics

Unit **F611:** Simple Systems

Advanced Subsidiary GCE

Mark Scheme for June 2014

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

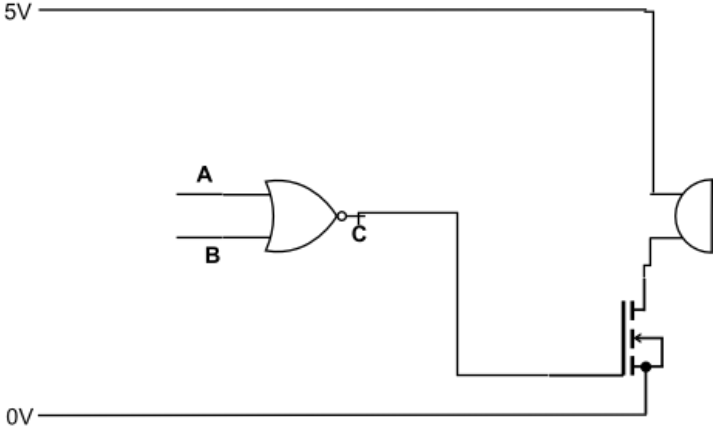
Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

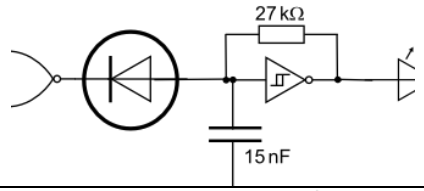
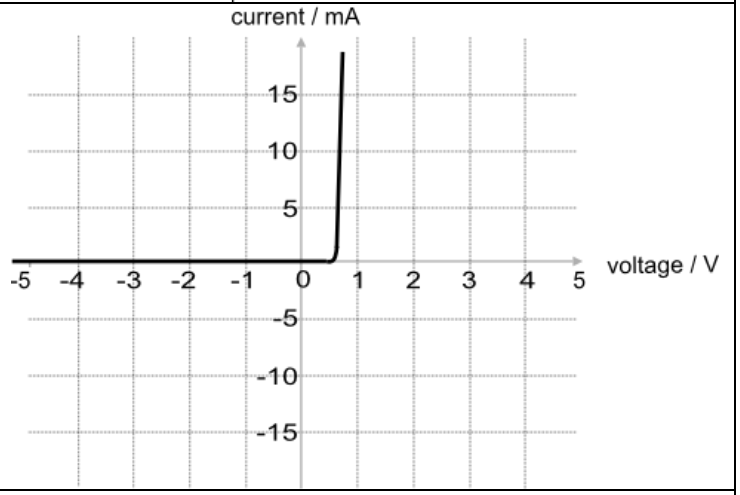
These are the annotations, (including abbreviations), including those used in scoris, which are used when marking

Annotation	Meaning of annotation
BP	Blank Page – this annotation **must** be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.

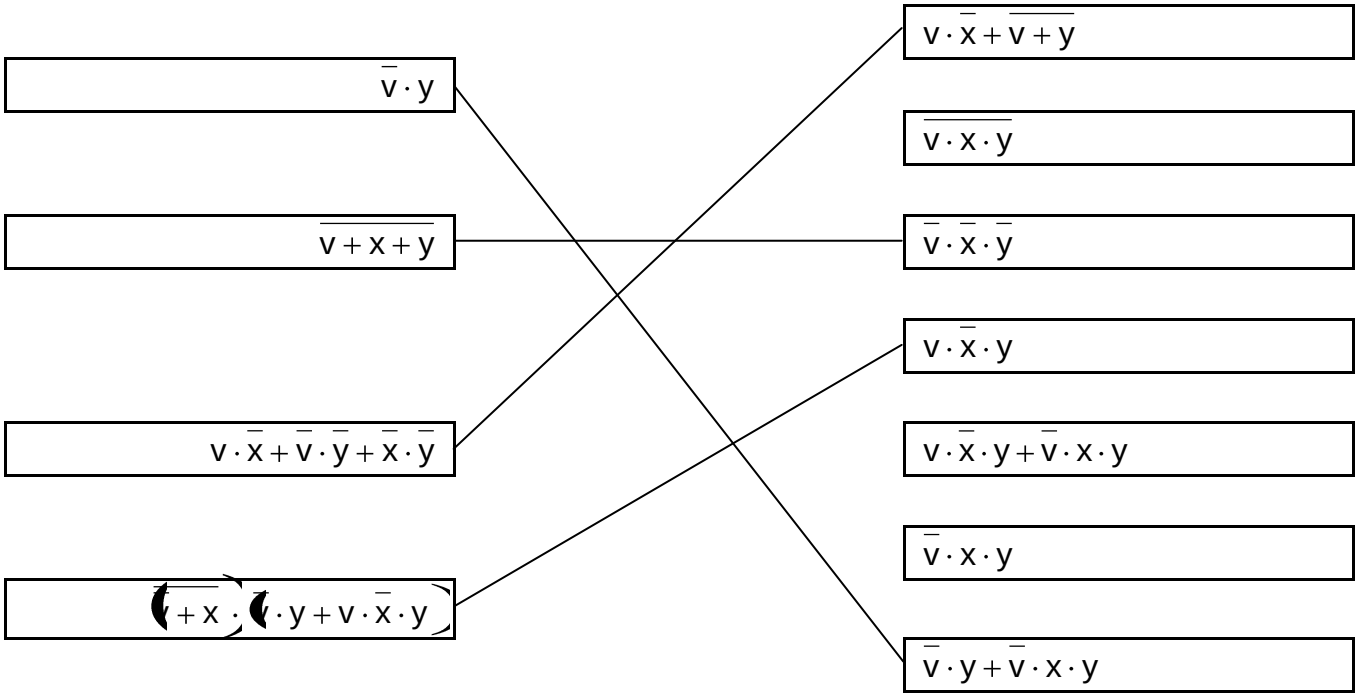
<table>
<tr><th>question</th><th>grade</th><th>expected answer</th><th>mark</th><th>additional guidance</th></tr>
<tr><td>1a</td><td>E</td><td>OR gate</td><td>1</td><td></td></tr>
<tr><td>1b</td><td></td><td><table><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table></td><td></td><td></td></tr>
<tr><td></td><td>E</td><td>all combinations of A and B</td><td>1</td><td></td></tr>
<tr><td></td><td>E</td><td>C correct</td><td>1</td><td></td></tr>
<tr><td>1c</td><td>C</td><td>$C = A + B$</td><td>1</td><td>$C = A \cdot B + \overline{A} \cdot B + A \cdot \overline{B}$</td></tr>
<tr><td>1d</td><td>C</td><td>Logic gates can only supply a few millamps at output (wtte)</td><td>1</td><td></td></tr>
<tr><td></td><td>C</td><td>MOSFET can <u>switch</u> large current (with virtually no current at gate) (wtte)</td><td>1</td><td>Allow MOSFETs <u>amplify</u> current for [1]</td></tr>
</table>

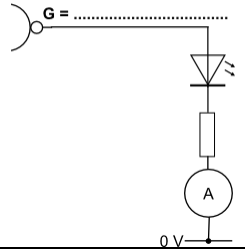
question	grade	expected answer	mark	additional guidance
1e	B	Correct MOSFET symbol	1	 Ignore anything connected to A or B unless connected to output
	D	MOSFET and buzzer in series with power	1	
	B	Source to 0 V Drain to buzzer	1	
	D	Gate to output of OR gate	1	

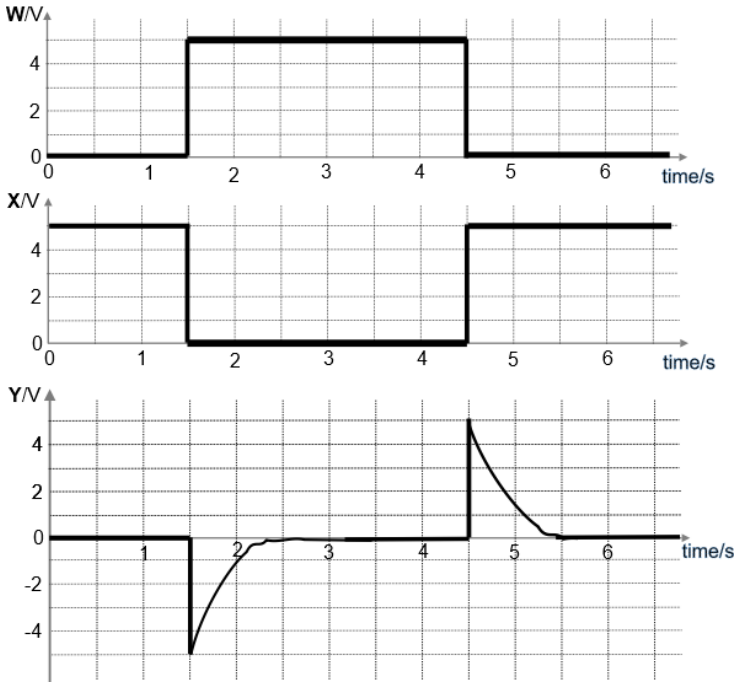
question	grade	expected answer	mark	additional guidance
2a	E	47k+68k=115k (adding resistors)	1	
	D	115000 Ω (units conversion)	1	correct unit conversion throughout calculation
	C	I = 15/115000 = 0.00013 A = 0.13 mA (calculation of current using 15V)	1	
	C	V = 68000 x 0.00013 = 8.87 V ≈ 9 V	1	8.87 V [4]
2b	C	It only conducts in one direction wtte	1	Diode behaviour
	D	It conducts when there is a pd of about 2V across it wtte	1	1.7 V – 4.5 V
2c	C	X = 8.87 V (9 V)	1	Allow other valid methods e.g. ratios
	B	I = 8.87/7500=0.00118A (9/7500=0.0012A)	1	
	A	V across LDR = 15-8.87=6.13V (15-9=6V)	1	
	A	R of LDR = 6.13/0.00118=5194Ω or 5183Ω (6/0.0012=5000Ω)	1	
2d	C	X < W	1	
	D	LDR high resistance	1	
	B	Y saturated low OR Y = -13V	1	
	A	LED reverse biased OR no current in LED	1	

question	grade	expected answer	mark	additional guidance
3a	E	ring around diode	1	
3b	D B	0 mA for negative voltages steep rise at about 0.7 V by eye [>0.5V <1V]	1 1	
3c	A E D	Voltage across R is 5-1.8=3.2V R=3.2/0.006 R=533Ω	1 1 1	Evidence of subtracting 1.8v from output Correct use of Ohm's law Correct answer 0.53Ω for [2] 5/0.006 for [2] 1.8/0.006 for [2] 5/6 for [1]

question	grade	expected answer	mark	additional guidance
3d	B	P is low, Q is high	1	
	C	S is low	1	
	D	Diode conducting so T is low	1	
	E	so output of Schmitt NOT U is high so LED glow	1	
3e	A	SW1 open, SW2 closed	1	
3f	E	use of 27kΩ and 15μF	1	
	B	correct conversion of units	1	
	E	$T=0.5 \times 27000 \times 15 \times 10^{-6} = 0.20s$ (0.203s)	1	calculation of period
	C	1/0.2=5Hz (4.938Hz) (ecf)	1	frequency from period
3g	E	correct symbol to output and 0V	1	(sawtooth) waveform in a circle
3h	E	square wave	1	
	B	2.5 squares high	1	
	A	2 periods on screen	1	

question	grade	expected answer	mark	additional guidance
4a	E	2nd table	1	
4b	B	1st table	1	
4c	A	4th table	1	
4d	A	1st table	1	
4e	AAAA	 One mark for each correct line	4	[0] if more than one line from a statement in LH column

question	grade	expected answer	mark	additional guidance
5a	E	$D = \overline{B}$	1	
	D	$E = A \oplus \overline{B} = A \cdot B + \overline{A} \cdot \overline{B}$	1	
	E	$F = \overline{\overline{B} + C}$	1	allow ecf from D
	E	$G = \overline{(\overline{B} + C) \cdot (A \oplus \overline{B})}$	1	allow ecf from E and F
5b	E	not needed, assumed to be there (wtte)	1	
	C	keeps the diagram uncluttered (wtte)	1	
5c	E	LED forward biased from G to 0V (through resistor and ammeter)	1	
	E	resistor in series with LED	1	
	E	ammeter in series with LED	1	

question	grade	expected answer	mark	additional guidance
6a	E	0V	1	
6b	E	0.47s	1	
6c	E A B A A	X inverse of W Y changes instantaneously from 0V to -5V at 1.5s Y changes instantaneously from 0V to 5V at 4.5s (ecf) Y decays exponentially (by eye) through half value between 0.2s and 0.4s after transition	1 1 1 1 1	
6di	A A A	Negative pulse much reduced./ clamps negative pulse (to -0.7V) logic gate contains clamping diodes/clamping diode from input to 0V positive pulse unchanged	1 1 1	

question	grade	expected answer	mark	additional guidance
6dii	E	LED lights	1	Allow flashes for 1 mark
	D	for a short time	1	Implied if < 1 s
	C	of 0.3s (0.3s-0.4s)	1	
6diii	C	voltage across resistor = 5-2=3V	1	
	D	I = V/R = 3/680 = 0.0044 A	1	
	E	0.0044 A = 4.4 mA	1	Conversion to mA

question	grade	expected answer	mark	additional guidance
7a	E	AND gate	1	
	E	Only turns the buzzer/output high on when both the inputs are high wtte	1	
7b	E	switches connected to 0 V	1	
	E	output from other end of switch	1	
	D	switch in series with resistor across power supply	1	
7c	E	easier to analyse operation of system (wtte)	1	
7d	E	flow of information	1	
7e	E	55/12 = 4.58 A	1	correct use of power equation
	E	4.58 x 2 = 9.17 A	1	correct dealing with two headlights
7f	E	SB683	1	
	E	the only switch that has a current rating above calculated value (wtte)	1	

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

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

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