

## **General Certificate of Education June 2010**

**ELECTRONICS** 

ELEC2

**Unit 2** Further Electronics

Mark Scheme

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	(a)	CKs commoned, ✓ Q to D, ✓ data input to first D <sub>A</sub> , ✓ Q to respective letter outputs ✓	4
	(b)	On the rising edge of the CK pulse, ✓ Contents moved one FF to the right ✓	2
1	(c)	clock cycle         A         B         C         D           0         0         1         0         1           1         1         0         1         0           2         1         1         0         1           3         1         1         1         0           4         1         1         1         1           5         0         1         1         1           6         0         0         1         1	4
		one mark for each of last four clock cycles ✓ ✓ ✓ ✓	

**Total Mark: 10** 

2	(a)	correct formula, ✓ substitution, ✓ answer, 714Ω ✓	3
	(b)	correct formula, ✓ substitution, ✓ answer, 771kΩ ✓	3
	(c)	between + and output, ✓ correct way round ✓	2
	(d)	Unchanged for much of the battery useful life ✓ 555 stops working when voltage becomes small (5V) ✓	2

**Total Mark: 10** 

3	(a)	(i)	D to inv. output, ✓ CK to inv. output, ✓ Resets together ✓ label astable input ✓ three labelled outputs ✓	5
	(a)	(ii)	AND gate, ✓ output to Reset, ✓ inputs from Y and Z ✓	3

		Binary cou	nter output	Dice	output		
		Denary	Binary Z Y X	Dice number	Lamps on		
		0	0 0 0	1	D		
3	(b)	1	0 0 1	2	А		5
		2	0 1 0	3	D, A		
		3	0 1 1	4	A, C		
		4	1 0 0	5	A, C, D		
		5	1 0 1	6	A, B, C		
		one per corre	ect answer ✓	·		-	

**Total Mark: 13** 

4	(a)		Formula, ✓ Substitution ✓ Gv=500 ✓	3
	(b)		Feedback resistor to output, ✓ Feedback resistor to – input, ✓ Resistor to + input, ✓ Resistor to 0V ✓	4
	(c)		Formula, ✓ substitution, ✓ 1.1MΩ ✓	3
	(d)	(i)	2.2kΩ ✓	1
	(d)	(ii)	Voltage follower - Input to +, ✓  – to output ✓	2

**Total Mark: 13** 

	(a)	(i)	5RC, ✓ 5 x 100 x 10 <sup>-7</sup> , ✓ = 50µs) ✓	3
	(a)	(ii)	Gv = 1+2.2 = 3.2, ✓ Vout = 3 x 3.2, ✓ = +9.6V ✓	3
5	(a)	(iii)	$T = RC = 10^{-7} \text{ x } 15\text{x}10^{8}, \checkmark$ = 150s \(	2
	(a)	(iv)	Output voltage decreases, ✓ exponentially with time ✓	2
	(b)		Input resistance of non-inverting amp very large cf inverting amp, ✓ so output voltage stays at higher level for longer. ✓	2

**Total Mark: 12** 

	(a)	Formula, ✓ substitution, ✓ only 4.7 ✓	3
6	(b)	Gain bandwidth calculation, ✓ BW=640kHz, ✓ Comment on MOSFETs – e.g. MOSFETs have good BW ✓	3
	(c)	Calculation, ✓ 9W in theory, ✓ in practice 5W ✓	3

**Total Mark: 9**