Electric circuits

Mark Scheme 3

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	Electricity and Magnetism
Sub-Topic	Electric circuits
Paper Type	(Extended) Theory Paper
Booklet	Mark Scheme 3

Time Allowed: **51 minutes**

Score: **/42**

Percentage: **/100**

1 **(a) (i)** $I_1 = I_2 + I_3$ B1

(ii) $I_1 = I_4$ OR same B1

(b) (i) ($V = IR$ = 0.80 × 3.0 =) 2.4 V A1

(ii) $I = V/R$ in any algebraic form OR 2.4 / 2 OR **(b)(i)** / 2
OR any voltage divided by 2 C1
($I_3 = V/R$ = 2.4 / 2 =) 1.2 A A
OR
I_3/I_2 = 3/2 (C1)
I_3 = 3/2 × 0.8 A = 1.2 A (A1

(iii) ($I_2 + I_3$ OR Current through R = 0.8 + 1.2) = 2.0 (A)
OR 6 V / 2 A used C1
Parallel combination formula: $1/r = 1/r_1 + 1/r_2$
OR (r =) $r_1r_2/(r_1 + r_2)$ C
Use of formula: combined resistance = 1.2 (Ω) C
(R + 1.2 = 6/2 = 3.0 Ω R =) 1.8 Ω A1
OR
Current through R = 0.8 + 1.2 = 2.0 (A) (
P.D. across R = 6.0 – 2.4 (C1)
= 3.6 (V) (C1)
R = 3.6 / 2.0 = 1.8 Ω (A1)

[Total: 9]

2 **(a)** Transistor B1

(b) Resistor / variable resistor / rheostat identified B1
Light-dependent resistor / LDR identified B1
Resistor or alternative in gap A; LDR in gap B B1

(c) Thermistor / thermal resistor / heat or temperature dependent resistor identified B1
Thermistor (or alternative name) in gap A and resistor in gap B B1

[Total: 6]

3 **(a) (i)** total R = 320 (Ω) or V per lamp = 6 (V)
I = (240/320 or 6/8 =) 0.75 A ecf from previous line — A1 [2]

(ii) use of $P = VI$ OR I^2R OR V^2/R — C1
4.5 W ecf from **(a)(i)** — A1 [2]

(b) resistance of each lamp = 8 × 1.05 = 8.4 (Ω)
total R = 240/0.9 = 266.7 (Ω) OR V per lamp = 8.4 x 0.9 = 7.56 (V) — B1
no. of lamps (= 266.7/8.4) = 31.7 OR (= 240/7.56) = 31.7 — B1
max. no. of failed lamps = 8 — B1
accept reverse logic [4]

[Total: 8]

4 **(a)** $1/R = 1/R_1 + 1/R_2$ or $R = R_1 R_2/(R_1 + R_2)$ or $R_1 R_2/(R_1 + R_2)$ or use of 1/8 = 1/24 + 1/X OR 8 = 24R/(24 + R) or calculations/clear logic to eliminate wrong values — C1 C1
12 Ω — A1 [3]

(b) battery and resistors correct, condone twin small circles, cell, zig-zag resistors
ammeter correct position — B1
ignore switches, condone breaks in circuit ≤ 1 mm condone wrong symbols if clear
two resistors in series scores 0/2 as ammeter cannot be in right place [2]

(ii) use of I = V/R in any form or V/R — B1
24 Ω resistor: I = (6/24=) 0.25 A — B1
other resistor: I = 6/his **(a)** correctly evaluated (6/12 = 0.5A) accept 1 s.f. if exact
if contradiction between answer of **(a)** in working and answer in answer line, base marking on answer line — B1 [3]

5	**(a)**	**(i)**	(I =) V/R **or** 230/46	C1	
			5.0 A *Unit penalty applies	A1	
		(ii)	(P =) IV **or** V^2/R **or** I^2R **or** 230 × 5 **or** $230^2/46$ **or** $5^2 \times 46$ ecf from **8(a)(i)**	C1	
			1100/1150/1200 W *Unit penalty applies ecf from **8(a)(i)**	A1	
	(b)		same as **8(a)(i)** (**c.a.o.**) *Unit penalty applies	B1	**[5]**

*Apply unit penalty once onl

6	**(a)**	**(i)**	light-dependent resistor/LDR	B1	
		(ii)	(in bright light) resistance of Z/LDR/circuit falls/is low	B1	
			current rises/is large/(starts to) flow/more p.d. across R	B1	
			relay (coil) magnetises/attracts/is magnet	B1	
			switch closes/completes second circuit	B1	
	(b)		<u>thermistor</u> replaces LDR **or** LDR removed **and** thermistor added	B1	**[6]**