

Electric circuits

Mark Scheme 4

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	Electricity and Magnetism
Sub-Topic	Electric circuits
Paper Type	(Extended) Theory Paper
Booklet	Mark Scheme 4

Time Allowed: 71 minutes

Score: /59

Percentage: /100

- 1 (a) (i) $1/R_p = 1/R_1 + 1/R_2$ OR $(R_p =) R_1 R_2 / (R_1 + R_2)$ in any form B1
 (ii) 1.5Ω B1 [2]
- (b) (i) correct position, allow across ammeter as well B1
 (ii) use of $V = IR$ in any form C1
 2.4 V OR $1.6 \times$ candidate's R_p V A1 [3]
- (c) reduced accept current decreases B1 [1]
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- 2 (a) (i) 4 V B1
 (ii) 12 V B1
- (b) (i) 6Ω B1
 (ii) $1/R = 1/3 + 1/6$ OR $(3 \times 6)/(3 + 6)$ C1
 2Ω A1
- (c) V/R OR $12/\text{candidate's (ii)}$ C1
 6 A ecf A1
- (d) (i) stays same B1
 (ii) decreases B1 [9]

- 3 (a) diode B1
- (b) (i) 2Ω B1
- (ii) 24 OR $22 + 2 (\Omega)$ seen C1
- $$1/R = 1/R_1 + 1/R_2 (+ 1/R_3) \text{ OR } (R =) \frac{R_1 R_2}{R_1 + R_2}$$
- seen or used with any 2 resistors
ignore extra resistance added to expression for R in equation C1
- 6Ω A1
- (c) N.B. marks may be scored anywhere in (c)
- (current =) zero / very small M1
- diode reverse biased
OR polarity wrong OR facing wrong way
OR diode only conducts R / + to L / - A1
- (d) use $I = V / R$ OR $P = VI$ OR $P = V^2 / R$ symbols, numbers or words M1
use of $R = 8 (\Omega)$ & correct calculation to give 2W
OR $R = 4 / 0.5 = 8 (\Omega)$ OR $R = 4^2 / 2 = 8 (\Omega)$
OR any other calculation(s) using ($I = V / R$ & $P = VI$) OR $P = V^2 / R$ to deduce $8 (\Omega)$ M1
- switch position B (NOTE: this is dependent on both M1s being scored)
ignore any calculations using 2Ω A1 [10]

- 4 (a) capacitor/capacitance/condenser B1
- (b) 5 Ω B1
- (ii) 5 and 20 both used OR 25 C1
- $1/R = 1/R_1 + 1/R_2$ OR $(R =) \frac{R_1 R_2}{R_1 + R_2}$ seen or used C1
- 4 Ω A1
- (c) EITHER ammeter reading falls (to zero) as capacitor charges OR no current/reading P already charged/does not conduct d.c. M1 A1
- (d) Formula for calculation of I ($I = V/R$) OR P ($P = V^2/R$) C
 Use of energy = power × time in any form C1
 400 s A1

[Total: 10]

- 5 (a) half-wave rectification clearly indicated (any wave shape, repeated):
 at least 2 humps with all spaces more than half width of hump, by eye. B1
- (b) (i) A (c.a.o.) M1
- (ii) For answers **A** and **B** only in (i), not **C** or **D**:
 Route to resistor: correct arrow on one downwards diode and nothing wrong on this route B1
 Route from resistor: correct arrow on one downwards diode and nothing wrong on this route B1 [4]

- 6 (a) (i) 0(A) / zero Unit penalty if wrong unit B1
- (ii) 12 V B1
- (b) (i) V / R OR $V = IR$ in any form, letters, words or numbers C1
0.5 A A1
- (ii) $8 \times$ candidate's (i) OR $8/24 \times 12$ C1
4 V OR 4.0 V e.c.f. A1
- (c) $1/R_1 + 1/R_2 = 1/R$ OR $R = R_1R_2 / (R_1 + R_2)$ in any form B1
5.3 (Ω) OR $5\frac{1}{3}$ (Ω) OR $16/3$ (Ω) C
12 / candidate's R C1
2.25 A c.a.o. A1
- Alternatively: $12/16 (= 0.75)$ OR $12/8 (= 1.5)$ C1
 $12/16 (= 0.75)$ AND $12/8 (= 1.5)$ C1
Currents added C1
2.25 A c.a.o. A1 [10]
- 7 (a) all 4 lights in parallel with supply and none in series B1
master switch in a place where it will work (cannot score if no supply or if short
circuit) B1
- one switch for 2 lights in living room AND one for bathroom
AND one for bedroom B1
- (b) (i) $W = V \times I$ or $100 = 200 \times I$ in any form C1
0.5 A or 0.5 a A1
- (ii) $I \times t$ or 0.5×60 e.c.f. C1
30 C or 30 c e.c.f. A1
- (c) (i) 135 W B1
- (ii) any power \times any time (words or symbols or numbers) C1
NOTE: 280 (W) is the total power of lamps in house, so counts as "power"
- 486 000 J or 486 kJ or 0.135 kWh accept lower case units A1
NOTE: $45 \times 3600 = 162000$ J gets e.c.f. from (i)