1	(a) (i)	$1/R_p = 1/R_1 + 1/R_2$ OR $(R_p =) R_1R_2/(R_1 + R_2)$ in any form	B1		
	(ii)	1.5 Ω	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 × candidate's R_p V	A1	[3]	
	(c)	reduced accept current decreases	B1	[1]	
2	(a) (i)	4 V	B1		
	(ii)	12 V	B1		
	(b) (i)	6 Ω	B1		
	(ii)	$1/R = 1/3 + 1/6$ OR $(3 \times 6)/(3 + 6)$	C1		
		2 Ω	A1		
	(c)	V/R OR 12/candidate's (ii)	C1		
		6 A ecf	A1		
	(d) (i)	stays same	B1		
	(ii)	decreases	B1	[9]	

3 **(a** diode B1

(b) (i) 2 Ω B1

(ii) 24 OR 22 + 2 (Ω) seen C1

1 / R = 1 / R_1 + 1 / R_2 (+ 1 / R_3) OR (R =) $\frac{R_1R_2}{R_1+R_2}$

seen or used with any 2 resistors
ignore extra resistance added to expression for R in equation C1

6 Ω 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 (Ω) & correct calculation to give 2W
OR R = 4 / 0.5 = 8 (Ω) OR R = 4^2 / 2 = 8 (Ω)
OR any other calculation(s) using (I = V / R & P = VI) OR $P = V^2 / R$ to deduce 8 (Ω) M1

switch position B (NOTE: this is dependent on both M1s being scored)
ignore any calculations using 2 Ω 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	OR	
ammeter reading falls (to zero)	no current/reading	M1
as capacitor charges	P already charged/does not conduct d.c.	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 × candidate's **(i)** OR 8/24 × 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 5⅓ (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 × I or 100 = 200 × I in any form — C1
0.5 A or 0.5 a — A1

(ii) I × 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 × 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 × 3600 = 162000 J gets e.c.f. from **(i)**

[10]