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) $1.5\,\Omega$ 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]

2 (a) (i) 4 V B1

(ii) 12 V B1

(b) (i) $6\,\Omega$ B1

(ii) $1/R = 1/3 + 1/6$ OR $(3 \times 6)/(3 + 6)$ C1
$2\,\Omega$ A1

(c) V/R OR 12/candidate's (ii) C1
6 A ecf A1

(d) (i) stays same B1

(ii) decreases B1 [9]

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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 $(R =) \dfrac{R_1 R_2}{R_1 + R_2}$

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

             6 Ω A1

   (c) N.B. marks may be scored anywhere in **(c)**

        (current =) zero / <u>very</u> 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 <u>both</u> M1s being scored)
        ignore any calculations using 2 Ω <u>A1</u> [10]

4 **(a** capacitor/capacitance/condenser   B1

  (b) $5\,\Omega$ B1

     (ii) 5 and 20 both used OR 25   C1

         $1/R = 1/R_1 + 1/R_2$ OR $(R =)\ \dfrac{R_1 R_2}{R_1 + R_2}$ seen or used   C1

         $4\,\Omega$ 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]