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 <u>and</u> 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   C1
1/8 = 1/24 + 1/X OR 8 = 24R/(24 + R) or calculations/clear logic to eliminate
wrong values   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]

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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 × 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]**