| Question | Answer | Mark |
|---|---|---|
| 1(a)(i) | 12 Ω | **B1** |
| (a) ( (ii) | / R = 1/R$_1$ + 1/R$_2$ OR 1/R = 1/12 + 1/6<br>OR (R = ) R$_1$R$_2$/(R$_1$ + R$_2$) OR (12 × 6)/(12 + 6)<br>4 Ω | **C1**<br>**A1** |
| (a)(iii) | 4 + 6 = 10 Ω | **B1** |
| (b)(i) | (I = 12/10 = ) 1.2 A | **B1** |
| (b)(ii) | (E =) IVt OR 1.2 × 12 × 50 OR I$^2$Rt OR 1.2$^2$ × 10 × 50<br>OR V$^2$t/R OR 12$^2$ × 50/10<br>720 J | **C1**<br>**A1** |
| | | **Total: 7** |

2 **(a** **(i)** P $=$ IV OR 40 $=$ 220 $\times$ I OR (I $=$) P/V OR 40/220
    0.18 A                              A1

    **(ii)** [3 $\times$ 0.18(2)] = 0.54 A OR 0.55 A           B

    **(iii)** 2/0.182 = 10.99 OR 2/0.18 = 11.1          C1
       10 lamps OR 11 lamps               A1

  **(b)** **(i)** Resistance <u>increases</u>                  B1

    **(ii)** Power (of lamp) decreases               B1
      P = IV <u>and</u> current in lamp decreases. OR P = $V^2$/R     B1

                             **[Total: 8]**

3 **(a** rheostat/<u>variable</u> resistor AND
   control/vary/change/ limit the current /resistance/power/ voltage <u>across heater</u>  [1]

  **(b)** (I $=$) P/V any form, words or numbers            [1]
     (I $=$) 1.25 (A) seen anywhere              [1]
     (V $=$) 6.0 – 3.6 OR 2.4 seen anywhere           [1]
     (R $=$) V/I in any form words or numbers          [1]
     1.92 $\Omega$ (2 or 3 sig. figs.)               [1]
     note: credit will also be given for alternative approaches

  **(c)** battery running down/going flat/energy <u>of battery</u> used up OR V or e.m.f. less
     OR more/increasing resistance (of heater) NOT resistance of X increases  [1]
     use of relationship between I and V or R OR the current decreases   [1]

4    **(a**    **(i)**    $1/R = 1/R_1 + 1/R_2$  OR  $R = R_1R_2/(R_1 + R_2)$  OR  with numbers    C1
       $(R =) 500\,\Omega$    A1

       **(ii)**    $I = (12 \div 1000) = 0.012\,A$ ecf **(i)**    B1

       **(iii)**    $(V =) IR$  OR  $0.012 \times 500$ OR $12 \times 500 \div 1000$    C1
          $= 6.0\,V$  ecf **(i)(ii)**    A1

   **(b)**    (more current in circuit so) current (in $500\,\Omega$ resistor) increases    B1

       resistance of parallel combination decreases
       OR total resistance (of circuit) decreases    B1

                                                              **[Total: 7]**

5    **(a**    **(i)**    ammeter symbol in series with wire    B1

       **(ii)**    different results OR graph can be plotted OR to ensure wire does not overheat    B1

   **(b) (i)**    $(P = ) VI$ OR $V = IR$ OR $250 \times 1.2$ OR $300\,(V)$
          $(P = ) I^2 R$ OR $250^2 \times 1.2$ OR $300 \times 250$    C1
          $75\,000\,W$ OR $75\,kW$

       **(ii)**    power loss reduced    C1
          resistance reduced    C1
          power lost decreases to a quarter OR $(P =) 19\,kW\,/\,18.75\,kW$

                                                              **[Total: 8]**

6  **(a**  tick for thermistor under: heat detector                                                B1
         tick for transistor under: switch                                                       B1


   **(b)**  increase light intensity / brightness / illuminate B                                  B1
           resistance (of B) decreases cao                                                        B1
           voltage at mid-point increases OR greater (share of) voltage                           M1
           (more) current flows (through lamp)                                                    A1

                                                                                       **[Total: 6]**


7  **(a**  **(i)**  diode                                                                          B1

         **(ii)**  **1.**  0.7 V                                                                   B1
                 **2.**  $I = V \div R$ in any form  OR  $(I =) V \div R$  OR  11.3÷4               C1
                         2.8 A                                                                     A1


   **(b)**  **(i)**  **1.**  (12÷8 =) 1.5 A                                                         B
                   **2.**  (1.5 + 2.825 =) 4.3 A ecf **(a)(ii)2.** and **(b)(i)1.**                 B1

         **(ii)**  1.5 A ecf **(b)(i)1.**                                                          B1

                                                                                       **[Total: 7]**