1   **(a)** **(i)** ($I =$) V/R OR $6/(12 + 4)$ OR $6/16$

            0.38 A / 0.37 A   A1

       (ii) $1/R = 1/R_1 + 1/R_2$
            OR ($R =$) $R_1 R_2 /(R_1 + R_2)$
            OR above with numbers substituted   C1

            $R = 3$ (Ω)   C1

            ($I = 6/3 =$) 2(.0) A   A1

            OR ALTERNATIVE METHOD:
            $6/12$ (C1)

            $+ 6/4$ (C1)

            2(.0) A   (A1)

    (b) **(i)** $R \propto l$ (in words or symbols)
            OR directly proportional OR e.g. R doubles when l doubles   B1

       (ii) $R \propto 1/A$ (or with words)
            OR inversely proportional OR e.g. R doubles when A halves   B1

    (c) $4/12$ OR 4:12 OR $1/3$ OR 1:3 OR 0.33   B1

                                                          [Total: 8]

2 (a 4.5 V ignore sign   B1

   (b) $1/R_p = 1/R_1 + 1/R_2$
        OR $(R_p =) R_1R_2/(R_1 + R_2)$ words, symbols or numbers   C1

        $R = (1/(1/1 + 1/5)) = 0.83\,\Omega$ A1

   (c) $V = IR$ in any form OR V/R words, symbols or numbers   C1

        use of total e.m.f. as V AND series resistance as R
        OR $4/5$ of total emf seen OR $1/6$ of total current seen   C1

        $(I = 4.5/5 =) 0.90\,A$ accept 0.9 e.c.f. from (a)   A1

   (d) 1.5 V ignore sign   B1

                                                                                   [Total: 7]

3 (a one mark for each correct entry in table: B3

resistor	res	current	potential difference	power
			IR	
		I		$2I^2R$

   (b) (i) $(P = IV = 750 \times 11000 =)\ 8.3 \times 10^6\,W\ (8300\,kW)$ B1

        (ii) $(V = IR = 750 \times 1.5 =)\ 1100\,V$ B1

        (iii) (voltage to factory = $11\,000 - 1125 =$) 9875 V   C1
              (power supplied to factory =) 9875×750 A1
              $7.4 \times 10^6\,W$ **OR** 7400 kW   A1
              OR
              power loss in cables = I^2R **OR** $750^2 \times 1.5$ (C1)
              $(=)\ 8.44 \times 10^5\ (W)$ (A1)
              (power to factory = $8.25 \times 10^6 - 8.44 \times 10^5 =$) $7.4 \times 10^6\,W$ **OR** 7400 kW (A1)

                                                                                   [Total: 8]

4 (a 6.0 V   B1

   (b) (i) coulomb (**IGNORE** C)   B1

        (ii) $(Q =) I\,t$
             OR $0.25 \times 12 \times 60$ **OR** 0.25×720 **OR** 0.25×12 **OR** 3.0 **OR** 0.25×60 **OR** 15   C1
             180 (C)   A1

        (iii) $(R =) V/I$ or $6.0/0.25$ or 24.0 e.c.f. from **(a)**
             OR
             $(V =) IR$ **OR** 0.25×16 **OR** 4.0 e.c.f. from **(a)**   C1

             8.0 Ω   A1

   (c) $R \propto l$ **OR** 8.0 **OR** $16/2$ C
        $R_1 R_2 /(R_1 + R_2)$ **OR** $1/R = 1/R_1 + 1/R_2$ **OR** $64/16$ **OR** $1/R = 1/8 + 1/8$ C
        4.0 Ω   A1

                                                                                         [Total: 9]

5 (a (i) all lamps off

        (ii) 12 Ω lamps (only) on   B1

        (iii) 4 Ω lamps (only) on

   (b)   12 V   B1

        (ii) $I = V/R$ in any form **OR** V/R **OR** 12/12   C1
              1.0 A **OR** 1 A   A1
              e.c.f. from **(b)(i)**

   (c) current in 4 Ω lamp = 3 (A) (current in 12 Ω lamp is in **(b)(ii)**)   C
        $(P =) IV$ **OR** $I^2 R$ C1
        $(P =)$ 36 W for 4 Ω lamp; $P = 12$ W for 12 Ω lamp   A1
        e.c.f. from **(b)(ii)**
        OR
        $(P =) V^2/R$ (C1)
        $(P =) 12^2/4 = 36$ W for 4 Ω lamp OR $12^2/12 = 12$ W for 12 Ω lamp   (C1)
        $(P =) 12^2/4 = 36$ W for 4 Ω lamp AND $12^2/12 = 12$ W for 12 Ω lamp   (A1)
        OR
        $(P =) V^2/R$ (B1)
        Same V for all lamps   (M1)
        4 Ω lamp has higher power / 12 Ω has lower power   (A1)

                                                                                         [Total 7]

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6   **(a**   **(i)**   current/electricity could flow through/across switch due to dampness / humidity

OR water (good) conductor   B1

danger of shock/electrocution   B1

accept alternative:
short (circuit)   (B1)
(danger because) lights go out when fuse blows   (B1)
       [2]

     (ii)   pull switch with long cord of insulating material
OR normal switch outside workroom
OR switch with non-contact operation / insulating cover / sensor actuation   B1   [1]

   (b)   friction with hose   M1

reasoning relating to charge moved <u>to / from aircraft</u> OR <u>to / from hose</u>
OR rubber insulates   A1   [2]

     (ii)   (water conducts) charge to / from aircraft OR away / to ground OR through tyres / wheels
OR earthing o.w.t.t.e.   B1   [1]

       [Total: 6]