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)** ($P = IV = 750 \times 11000$ =) 8.3×10^6 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
7.4×10^6 W **OR** 7400 kW A1
OR
power loss in cables = I^2R **OR** $750^2 \times 1.5$ (C1)
(=) 8.44×10^5 (W) (A1)
(power to factory = $8.25 \times 10^6 - 8.44 \times 10^5$ =) 7.4×10^6 W **OR** 7400 kW (A1)

[Total: 8]

4 **(a** 6.0 V B1

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

(ii) (Q =) It
OR 0.25 × 12 × 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
$R_1R_2/(R_1 + R_2)$ **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^2R 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]

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) (danger because) lights go out when fuse blows	 (B1) (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]