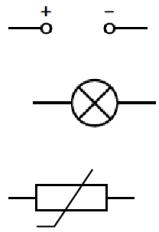
01. 0625_m23_ms_42 Q: 7

Question	Answer	Marks
(a)	work done in passing charge through / across a component	**B1**
	work done per unit charge	**B1**
(b)(i)	(definition of emf:) $E = W / Q$	**B1**
(b)(ii)	270 J	**A2**
	$W = EQ$ **OR** 9.0×30	(C1)

Question	Answer	Marks
(c)(i)	correct symbols for d.c. power supply, a lamp and a thermistor 	**B1**
	three components in a complete series circuit	**B1**
(c)(ii)	resistance (of thermistor) decreases (when temperature increases)	**B1**
	resistance of circuit decreases **OR** greater current (in lamp so brightness of lamp increases) **OR** greater p.d. across lamp (so brightness of lamp increases)	**B1**

02. 0625_s23_ms_41 Q: 7

Question	Answer	Marks
(a)	any **two** from: • (potential divider) splits / shares / divides the e.m.f. / voltage / potential difference / p.d. (of a power source / in a circuit) • (e.m.f. is) split between (two) resistors / components (connected in series to power source) • (potential divider shares e.m.f.) in proportion to the resistances (of the resistors / components)	**B2**
(b)(i)	(e.m.f. =) 15 V	**B1**
(b)(ii)	(resistance =) 60 Ω	**A3**
	(R_{II} =) $R_2R_3 / (R_2 + R_3)$ **OR** (R_{II} =) $40 \times 40 / (40 + 40)$ **OR** (R_{II} =) 1600 / 80 **OR** $1 / R_{II} = 1 / R_2 + 1 / R_3$ **OR** $1 / R_{II} = 1 / 40 + 1 / 40$ **OR** (R_{II} =) $(1 / 40 + 1 / 40)^{-1}$ **OR** (R_{II} =) 20 (Ω)	C1
	(resistance =) 40 + (candidate's value for combined resistance of R_2 and R_3)	C1

Question	Answer	Marks
(c)	(reading =) 10 V	**A2**
	emf shared in same proportion as resistance **OR** e.g. $R_1 / R_{II} = V_1 / V_{II}$ **OR** (reading =) $15 \times 40 / 60$ **OR** (reading =) 0.25×40	C1

03. 0625_s23_ms_42 Q: 8

Question	Answer	Marks
(a)(i)	region in which a (magnetic) pole experiences a force	**B1**
(a)(ii)	in the direction of the force on the N pole	**B1**

Question	Answer	Marks
(b)	4 radial lines outside sphere, touching the sphere and equally spaced all around sphere	**B1**
	direction of arrows towards the sphere	**B1**
(c)(i)	2.0 V	**A1**
(c)(ii)	(ratio of p.d. across $R_2 : R_3$ =) 1 : 2	**B1**
(c)(iii)1.	current is zero in R_1 **AND** diode is in wrong direction (to allow current) owtte	**B1**
(c)(iii)2.	(ratio of p.d. across $R_2 : R_3$ =) 1 : 1	**B1**

04. 0625_w23_ms_41 Q: 8

Question	Answer	Marks
(a)(i)	900 C	**A2**
	$I = Q / t$ **OR** (Q =) It **OR** 1.5 × 600	C1
(a)(ii)	2.0 Ω	**A3**
	$R = V / I$ **OR** (R_{tot} =) V / I **OR** 9.(0) / 1.5 **or** 6.(0)	C1
	(R_{cyl} =) total resistance – P **OR** (R_{cyl} =) 6.0 – 4.0	C1
(b)	1200 s	**A4**
	R is directly proportional to l **OR** (new cylinder) twice as long means twice R	C1
	R is inversely proportional to A **OR** (new cylinder) half cross-sectional area means twice R	C1
	(resistance of cylinder =) 4 × **(a)(ii)** (Ω)	C1

05. 0625_w23_ms_42 Q: 6

Question	Answer	Marks
(a)	(p.d. across LED = 4.5 – 1.2 =) 3.3 V	**A2**
	(V =) IR	C1
(b)	LED (is a diode, which) only allows current in one direction / has a very high resistance (when direction of current is reversed.) OR (it) is reverse-biased	**B1**
(c)	$E=IVt$ **OR** (t =) E / VI **OR** $Q = E / V$ **AND** $Q = I \times t$	**B1**
	(t =) 1050 ÷ [0.02 × 4.5 × 3600] **OR** (t =) 3.2 h	**B1**
(d)	(charge =) 72 C	**A2**
	$I = Q / t$ **OR** (Q =) It **OR** (Q =) 0.02(0) × 3600	C1

06. 0625_w23_ms_43 Q: 6

Question	Answer	Marks
(a)	sketch: one axis labelled *V* and the other labelled *I*, either way round AND gradual curve from origin curving such that *V* / *I* increases	**B1**
	explanation: (as current / temperature increases so) resistance increases	**B1**
	(so) more voltage required for same increase in current owtte **OR** if *V* on *y*-axis: gradient must increase **OR** if *V* on *x*-axis: gradient must decrease	**B1**
(b)(i)	9.0 V	**A2**
	12.0 – 3.0	C1
(b)(ii)	2.1 A	**A2**
	I = *V* / *R* **OR** (*I* =) *V* / *R* **OR** 9.0 / 4.2	C1
(b)(iii)	0 (A)	**A1**
(b)(iv)	(ammeter reading) 2.1 A	**A1**
(b)(v)	19 W	**A2**
	P = *VI* **OR OR** (*P* =) *VI* **OR** 9 × 2.1	C1

07. 0625_m22_ms_42 Q: 7

Question	Answer	Marks
(a)	8 (cells)	**B1**
(b)(i)	(12 / 2.4 =) 5.0 Ω	**A2**
	R = V / I in any form	**(C1)**
(b)(ii)	(Resistance of Q = 5–1.5) = 3.5 Ω	**A2**
	1 / R = 1 / R_1 + 1 / R_2 OR R= R_1R_2 / (R_1+R_2)	**(C1)**

Question	Answer	Marks
(c)(i)	correct voltmeter symbol connected correctly across both lamps	**B1**
(c)(ii)	4.3 W	**A3**
	(P =) IV in any form OR 1.2 × 3.6	**(C1)**
	3.6 V **OR** 1.2 A	**(C1)**

08. 0625_s22_ms_42 Q: 9

Question	Answer	Marks
(a)(i)	0 (A)	**B1**
(a)(ii)	(I = 12 / 2 =) 6.0 A	**A2**
	(I =) V / R in any form	C1
(a)(iii)	(I = 12 / 5 =) 2.4 A	**A2**
	($R_s = R_1 + R_2$ = 2 + 3 =) 5 (Ω)	C1
(b)	(R_p = 6 / 5 =) 1.2 Ω	**A3**
	$1/R_p = 1/R_1 + 1/R_2$ OR (R_p =) $R_1 R_2 / (R_1 + R_2)$	C1
	$1/R_p = 1/2 + 1/3$ OR (R_p =) $2 \times 3 / (2 + 3)$	C1

09. 0625_s22_ms_43 Q: 8

Question	Answer	Marks
(a)(i)	light-dependent resistor / LDR	**B1**
(a)(ii)	voltmeter connected in parallel with component Y	**B1**
(a)(iii)	1 0.016 A	**A2**
	(I =) V/R in any form **or** 12/400 **or** 12/350 **or** 12/750 OR ($R_{total} = R_1 + R_2$ =) 750 (Ω)	C1
	2 6.4 V	**A1**
(a)(iv)	(in a dark room the p.d. across component Y) decreases	**B1**
(b)	one named practical application of LDR e.g. switch on street lights (at night) / turn on security light (at night)	**B1**

10. 0625_w22_ms_41 Q: 8

Question	Answer	Marks
(a)	both relate to energy per unit charge	**B1**
(b)	e.m.f. applies to the whole circuit / source **or** p.d. to one (or more) component **or** energy conversion to electrical for e.m.f. **or** from electrical for p.d.	**B1**
(c)(i)	4.8 V	**B1**
(c)(ii)	20 Ω	**A3**
	$1/R_T = 1/R_1 + 1/R_2$ **or** (R_T =) $R_1 R_2 / (R_1 + R_2)$ **or** $1/R_T = 1/24 + 1/12$ **or** $1/R_T = 3/24$ **or** (R_T =) $24 \times 12 / (24 + 12)$	C1
	8.0 (Ω)	C1
(c)(iii)	2.9 V	**A2**
	$V = ER/R_T$ in any form **or** $4.8 \times 12 / 20$ **or** $I = E/R$ in any form **or** 0.24 seen	C1

11. 0625_m21_ms_42 Q: 8

	Answer	Marks
(a)	energy supplied by a source in driving charge around a complete circuit / energy needed to drive unit charge / 1 coulomb round circuit	**B1**
(b)(i)	(*P*=) 90 W	**A3**
	(*P*=) *V I* in any form	C1
	(*V* / *R* OR *I* =) 2	C1
(b)(ii)	(p.d. =) 15 V	**A2**
	(p.d. =) 60 – 45	C1
(b)(iii)	(*I* = 15 / 10 =) 1.5 A	**A2**
	(*I* =) *V* / *R* OR *V* = *IR* in any form	**C1**

12. 0625_s21_ms_41 Q: 8

	Answer	Mark
(a)	 **and** between P and Q	**B1**
(b)	1.5 V **c.a.o.**	**B1**
(c)(i)	1600 Ω	**A3**
	($V_{800\,\Omega}$ =) 4.0 (V)	**C1**
	(*I* =) *V* / *R* in any form or 4.0 / 800 or 0.0050 (A) **or** (*R* =) *V* / *I* or 8.0 / 0.0050	**C1**
	OR 1600 Ω	**(A3)**
	($V_{800\,\Omega}$ =) 4.0 (V)	**(C1)**
	(R_{Th} =) $R_{800\,\Omega} \times V_{Th} / V_{800\,\Omega}$ in any form **or** (R_{Th} =) 800 × 8.0 / 4.0 in any form	**(C1)**
	OR 1600 Ω	**(A3)**
	$\frac{12}{800+R_{Th}}$ **or** $\frac{8.0}{R_{Th}}$ **or** $\frac{R_{Th}}{800+R_{Th}}$	**(C1)**
	$\frac{12}{800+R_{Th}} = \frac{8.0}{R_{Th}}$ in any form	**(C1)**

	Answer	Mark
(c)(ii)	larger proportion of the e.m.f. (across thermistor) **or** smaller voltage across 800 Ω	**B1**
	temperature (of thermistor) is smaller / has decreased	**B1**
	resistance of thermistor / circuit is large(r)	**B1**

13. 0625_s21_ms_42 Q: 10

	Answer	Mark
(a)	V = IR in any form or (R =) V / I	**C1**
	(R = 9.2 / 0.004 =) 2300 Ω	**A1**

	Answer	Mark
(b)	(much) greater current in lamp OR lamp activated / lights / glows / gets brighter owtte	B1
	resistance of thermistor / component / K reduced (compared to value at (very) low temperature)	B1
	voltage / p.d. of point X / across R increases	M1
	(larger) current in lamp	A1
(c)	thermistor	B1

14. 0625_s21_ms_43 Q: 7

	Answer	Mark
(a)	energy supplied	M1
	to drive a unit charge / 1 C round a complete circuit	A1
(b)(i)	(R =) 2.3 Ω OR 2.2 Ω	A3
	$R = V/I$ in any form	C1
	current in R = 4 (A) OR p.d. across R = 9 (V)	C1
(b)(ii)	1.1 Ω	A3
	resistance proportional to length (so twice length twice resistance)	C1
	resistance inversely proportional to area (so twice diameter decreases resistance by factor of 4)	C1

15. 0625_w21_ms_41 Q: 8

Question	Answer	Marks
(a)	Q / t **or** (rate of) flow of (electric) charge / electrons	B1
(b)	(current in the 450 Ω resistor =) $I_2 - I_1$	B1
(c)	($V_{450\,\Omega}$ =) IR **or** 0.012×450 **or** 5.4 (V) **or** 9.0 – 5.4 **or** 3.6 (V) seen	C1
	(I =) 3.6 / 800 **or** 0.0045 (A)	C1
	(P =) VI **or** 3.6×0.0045 **or** $3.6^2 / 800$	C1
	1.6×10^{-2} W **or** 16 mW	A1
(d)	resistance (of LDR) decreases	B1
	current (in circuit) increases **or** resistance of parallel pair decreases	C1
	p.d. across 800 Ω resistor increases **and** p.d. across 450 Ω resistor decreases **or** resistance of parallel pair a smaller fraction of total resistance **and** p.d. across 450 Ω resistor decreases	A1

16. 0625_w21_ms_42 Q: 9

Question	Answer	Marks
(a)	7.5 V	**B1**
(b)(i)	$1 / R_p = 1 / R_1 + 1 / R_2$ OR $(R_p =) R_1R_2 / (R_1 + R_2)$ in any form	**C1**
	$(R_p =) 1.2\ (\Omega)$	**C1**
	$3.2\ \Omega$	**A1**
(b)(ii)	(V =) IR in any form	**C1**
	4.1 V	**A1**

17. 0625_w21_ms_43 Q: 9

Question	Answer	Marks
(a)(i)		**B2**
	four components joined in series	B1
	all circuit symbols correct for resistor, thermistor, a filament lamp and a power supply	B1
(a)(ii)	voltmeter connected in parallel to the resistor	**B1**
(a)(iii)	(p.d. across terminals of power supply) = 18 V	**A4**
	(current through resistor when p.d. across it is 6.0 V =) 0.4 A	C1
	current same through all components in series circuit OR horizontal line through 0.4 A on graph through all three curves OR p.d. across filament lamp = 3.0 V OR p.d. across thermistor = 9.0 V	C1
	p.d. across filament lamp = 3.0 V AND p.d. across thermistor = 9.0 V	C1
(b)	any sensible use requiring temperature control or depending on temperature, e.g. fire alarms, to keep computers cool (by operating fan), in incubators, electronic thermometer, electronic thermostat in kettle / car engine	**B1**

18. 0625_m20_ms_42 Q: 8

(a)	$\{R_s = R_1 + R_2 + R_3$ in any form OR $(R_s) = R_1 + R_2 + R_3$ OR $(R_s) = 3 + 2 + 6\ (\Omega)$ OR $(R_s) = 11\ (\Omega)\}$ AND {V= IR in any form OR (I=)V / R OR (I=) 12 / 11 (A)}	**C1**
	(I=) 1.1 A	**A1**
(b)	uses resistance of wire proportional to length OR (resistance XQ =) 6 Ω 0.6 / 2.0 (Ω) OR 1.8 (Ω)	**B1**
	$1 / R_p = 1 / R_1 + 1 / R_2$ OR $(R_p=) R_1R_2 / (R_1 + R_2)$	**C1**
	$1 / R_p = 1 / 1.5 + 1 / (6 \times 0.6 / 2)$ OR $(R_p=) 1.5 \times (6 \times 0.6 / 2) / (1.5 + 6 \times 0.6 / 2)$ OR $(R_p= 1.5 \times 1.8 / \{1.5 + 1.8\}) = 0.82\ (\Omega)$	**C1**
	$(R = 3 + 2 + 0.82 =) 5.8\ \Omega$	**A1**

19. 0625_s20_ms_41 Q: 8

(a)	990 / (54 / 1.2) OR 990 / 45 OR (number of cells in pack =) 54 / 1.2 OR 45	C1
	22	A1
(b)(i)	(*P* =) *EI* OR 1.2 × 3.5	C1
	4.2 W OR 4.2 J / s	A1

(b)(ii)	thick wires have a smaller resistance	B1
	less thermal energy generated in wires	B1
	more efficient OR less risk of fire / insulation melting	B1

20. 0625_s20_ms_42 Q: 8

(a)	two circuit symbols correct	B1
	three circuit symbols correct	B1
	symbol for cell, battery or power supply AND two other circuit symbols in series	B1
	LED correct way round	B1
(b)	R = V / I in any form OR (R =) V / I	C1
	(R = 3.1 / 0.030 =) 100 Ω	A1
(c)(i)	uses 10.5 = 2.1 + V across heater	C1
	(R = 8.4 / 1.5 =) 5.6 Ω	A1
(c)(ii)	P = VI in any form OR (P =) VI	C1
	(P = 8.4 × 1.5 =) 12.6 W	A1

21. 0625_w20_ms_42 Q: 10

Question	Answer	Marks
(a)(i)	recognisable ammeter in gap AB AND straight lines in CD AND EF	B1
(a)(ii)	recognisable voltmeter across 4 Ω	B1
	correct voltmeter symbol used	B1
(a)(iii)	$V = IR$ in any form or ($V =$) IR words, symbols or numbers	C1
	($V_{2\Omega} = 2 \times 2.5 =$) 5 V	C1
	($I_{4\Omega} = 5 \div 4 =$) 1.3 A must be clear that I refers to 4 Ω OR calculates $R_p = 1.33\ \Omega$ OR $4 \div 3\ \Omega$	C1
	($I_{6\Omega} = 2.5 + 1.3 =$) 3.8 A OR ($I_{6\Omega} = 5 \div 1.33 =$) 3.8 A	A1
	Alternative route for first 3 mps	
	I proportional to $1 \div R$ OR $I_{2\Omega} \times R_{2\Omega} = I_{4\Omega} \times R_{4\Omega}$	C1
	$I_{4\Omega} = I_{2\Omega} \div 2$	C1
	($I_{4\Omega} = I_{2\Omega} \div 2 = 2.5 \div 2 =$) 1.3 A	C1
	Alternative route by potential divider	
	$V = IR$ in any form or ($V =$) IR words, symbols or numbers	C1
	($V_{2\Omega} = 2 \times 2.5 =$) 5 V	C1
	$V_T = 7.33 \times 5 \div 1.33$ (= 27.51 V)	C1
	($I_{6\Omega} = 27.51 \div 7.33 =$) 3.8 A	A1

Question	Answer	Marks
(b)	any sort of triangle symbol pointing to left in EF	B1
	a wire in CD	B1

22. 0625_m19_ms_42 Q: 9

(a)	I = V/R in any form OR (R=) V/I OR 7.0 / 4.6	C1
	1.5 Ω	A1
(b)	Resistor: resistance is constant	B1
	Thermistor: resistance decreases	B1
(c)(i)	4.6 + 4.6	C1
	9.2 A	A1
	OR Combined resistance = (1.52^2 / (1.52 + 1.52) =) 0.76 Ω	(C1)
	(I =) 7.0 / 0.76 = 9.2 A	(A1)
(c)(ii)	(E =) IVt OR in words OR 9.2 × 7 × 5 × 60	C1
	19000 J	A1

23. 0625_s19_ms_41 Q: 7

(a)	thermistor **c.a.o.**	**B1**
(b)(i)	$V_X = V_{30}$	**B1**
(b)(ii)	$V_X = E - V_{20}$ in any form	**B1**
(c)(i)	$1/R_1 + 1/R_2 = 1/R_{tot}$ **OR** $(R_{tot} =) R_1 R_2 / (R_1 + R_2)$ **OR** 1/15 + 1/30 = $1/R_{tot}$ **OR** (15 × 30) / (15 + 30)	**C1**
	10 (Ω) **OR** 10 + 20	**C1**
	30 Ω	**A1**
(c)(ii)	$I = V / R$ in any form **OR** $(I =) V / R$ **OR** 6.0 / 30	**C1**
	0.20 A	**A1**
(d)	resistance of X decreases	**B1**
	ammeter reading / it increases **and** (total) resistance (of circuit) decreases / more voltage across 20 Ω resistor	**B1**

24. 0625_s19_ms_42 Q: 10

(a)	$1/R_p = 1/R_1 + 1/R_2$ OR $(R_p =) 1/(1/R_1 + 1/R_2)$ OR $(R_p =) R_1R_2/(R_1 + R_2)$ OR (0.2 × 0.3)/ (0.2 + 0.3) OR 0.6 × 0.2	**C1**
	$(R_p =) 0.12$ (Ω)	**C1**
	$(R_t = 0.12\ Ω + 0.20\ Ω =) 0.32\ Ω$	**A1**
(b)	Statement : resistance of lamp increases	**M1**
	Explanation : temperature of lamp increases	**A1**

25. 0625_w19_ms_43 Q: 9

(a)(i)	voltmeter shown connected across LED		**B1**
(a)(ii)	ammeter shown connected in series with LED		**B1**
(b)	p.d. across two resistors in parallel = (3.7 – 2.1 =) 1.6 V	resistance of circuit = (3.7 / 0.19) = 19.5 Ω AND resistance of LED (= 2.1 / 0.19) = 11.1 Ω	**B1**
	combined resistances of two resistors in parallel = R / 2 OR $1 / R = 1 / R_1 + 1 / R_2$ OR $R = R_1 R_2 / R_1 + R_2$ OR current in either R = I / 2	resistance across parallel combination of resistors = (19.5 – 11.1) = 8.4 Ω	**B1**
	$R = V / I$ in any form	$R = V / I$ in any form	**C1**
	$R / 2 = 1.6 / 0.19$	$R / 2 = 8.4$ Ω	**C1**
	17 Ω	17 Ω	**A1**

26. 0625_m18_ms_42 Q: 9

(a)(i)	Resistor: tick in 2nd box	**B1**
(a)(ii)	Lamp: tick in 1st box	**B1**
(b)	(R =) V / I OR (R =) 6.0 / 4.4	**C1**
	1.4 Ω	**A1**
(c)	Current in lamp = 4.4 A Current in resistor = 4.0 A	**C1**
	Current from supply (= 4.0 + 4.4) = 8.4 A	**A1**
	OR (With 6 V p.d.) R_L = 6 / 4.4 = 1.36 Ω R_R = 6 / 4 = 1.5 Ω Combined resistance = (1.36 × 1.5) / 2.86) = 0.71 Ω	**(C1)**
	Current = 6 / 0.71 = 8.4 A	**(A1)**
(d)	p.d. across lamp = 4.9 V p.d. across resistor = 6.0 V	**C1**
	Total p.d. (= 4.9 + 6.0) = 10.9 V	**A1**
	OR (With 4 A current) R_L = 5 / 4 = 1.25 Ω R_R = 6 / 4 =1.5 Ω Total R = 2.75 Ω	**(C1)**
	Total p.d. = 2.75 × 4 = 11.0 V	**(A1)**

27. 0625_s18_ms_41 Q: 7

(a)	(Metals) contain free/mobile electrons/delocalised electrons	**1**
(b)(i)	R α L **and** R α 1 ÷ A **OR** R α L ÷ A **OR** R = 16 × ½ ÷ 2 **OR** R = 16 ÷ 4	**1**
	4.0 Ω	**1**
(b)(ii)	1 ÷ R = (1 ÷ R_1) + (1 ÷ R_2) **OR** R = (R_1 × R_2) ÷ (R_1 + R_2) **OR** (1 ÷ R) = (1 ÷ 4) + (1 ÷ 16) **OR** (4 × 16) ÷ (4 + 16)	**1**
	3.2 Ω	**1**
(c)(i)	3E or 3 × E	**1**
(c)(ii)	$I_B > I_2 > I_1$ (6th box ticked)	**1**

28. 0625_s18_ms_42 Q: 8

(a)(i)	variable resistor **OR** rheostat	**1**
(a)(ii)	voltmeter symbol correctly connected across 20 Ω resistor	**1**
(b)	*(I =) V ÷ R* **OR** 6.0 ÷ 20 **OR** (any value < 6.0) ÷ 20	**1**
	correct calculation of I for V>0 accept point on graph with correct co-ordinates, apart from the origin	**1**
	straight line from (0,0) to (6.0,0.30) tolerance within ½ small square	**1**
(c)(i)	(combined resistance) less (than the resistance of either/smaller resistor)	**1**
(c)(ii)	steeper **OR** gradient greater **OR** description of how the line differs (e.g. reaches 0.40 A before V reaches 6.0 V) ignore 2nd line above 1st line	**1**

29. 0625_s18_ms_43 Q: 9

(a)	(R =) $V \div I$ **OR** 12 ÷ 0.15	**C1**
	80 Ω	**A1**
(b)(i)	increases	**B1**
(b)(ii)	(voltmeter reading) decreases **OR** less p.d. across variable resistor	**B1**
	more p.d. across 20Ω/fixed resistor	**B1**
(c)(i)	1.5 J of (electrical) energy supplied in driving charge around the circuit	**B1**
	energy per unit charge **OR** per coulomb	**B1**
(c)(ii)	8	**B1**

30. 0625_w18_ms_41 Q: 9

(a)	2 lamps with correct circuit symbol, in parallel, with correct connection to battery	**B1**
(b)(i)	(12 / 6.0 =) 2.0 A	**B1**
(b)(ii)	(P =) IV OR 2.0 × 12	**C1**
	OR (P =) I^2R OR $2.0^2 \times 6.0$	**(C1)**
	OR (P =) V^2 / R OR $12^2 / 6.0$	**(C1)**
	24 W	**A1**
(c)	(E =) IVt OR Pt in any form OR 36 × 20	**C1**
	= 36 × 20 × 60 × 60	**C1**
	= 2.6×10^6 J	**A1**

31. 0625_w18_ms_42 Q: 7

(a)(i)	$P = I\ V$ in any form OR (I =) P / V	**C1**
	(I = 60 / 110 =) 0.55 A	**A1**
(a)(ii)	(I =) 1.6 A	**B1**
(a)(iii)	110 V	**B1**
(b)(i)	$I = V / R$ in any form OR (R =) V / I OR (R =) V^2 / P OR (R=) P / I^2	**C1**
	(R = 110 / 0.55 =) 200 Ω	**A1**
(b)(ii)	2nd box (twice the length)	**B1**
	4th box (half the area of cross-section)	**B1**

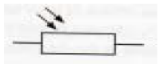
32. 0625_w18_ms_43 Q: 8

(a)	from chemical (energy) to thermal / heat (energy)	**C1**
	from chemical (energy) to thermal / heat (energy) **and** as a result of electrical working	**A1**
(b)(i)	(I =) V/R **or** 2.4 / 120	**C1**
	0.020 A	**A1**
(b)(ii)	6.6 V	**B1**
(b)(iii)	330 Ω	**B1**
(c)	multiplication by 5.0 **or** $R \propto l$	**C1**
	multiplication by 2.0 / 4.0 **or** division by 0.50 / 0.25 **or** $R \propto 1/A$ **or** $R \propto 1/r^2$	**C1**
	multiplication by 4.0 **or** division by 0.25 **or** 20 × 330	**C1**
	6600 Ω	**A1**

33. 0625_m17_ms_42 Q: 9

(a)(i)	Resistance constant	**B1**
(a)(ii)	Resistance increases	**B1**
(b)(i)	I = V/R in any form OR (R=) V/I	**C1**
	8.0/0.72	**C1**
	11 Ω	**A1**
(b)(ii)	(P =) IV OR 0.72 × 8.0	**C1**
	5.8 W	**A1**
	OR I^2R OR 0.72^2 × candidate's **(b)(i)** OR V^2/R OR 8^2 / candidate's **(b)(i)**	(C1)
	5.7 W or 5.8 W (dependent on exact data used)	(A1)
(c)(i)	8.0 V	**B1**
(c)(ii)	(5 × 0.72 =) 3.6 A	**B1**
	Total:	**9**

34. 0625_s17_ms_41 Q: 9

(a)(i)	LDR OR light-dependent resistor	B1
(a)(ii)		B1
(b)(i)	$I = V/R$	C1
	(total resistance =) 1.2 + 2.4 OR 3.6 seen	C1
	I = 6.0 / (1.2 + 2.4) OR 1.67 or 1.7 (mA)	C1
	(V =) 4.0 V	A1
	OR (V_1)= [R_1 / (R_1 + R_2)] V	(C1)
	(total resistance =) 1.2 + 2.4 OR 3.6 seen	(C1)
	(V_1) = (2.4 / 3.6) 6.0	(C1)
	= 4.0 V	(A1)
(b)(ii)	Replace the 1.2 kΩ resistor with one of higher value OR Increase the temperature (of the thermistor or the room)	B1
	Total:	**7**

35. 0625_s17_ms_42 Q: 8

(a)(i)	P=VI in any form OR (I =) P / V	C1
	(I = 9.0 / 6.0 =) 1.5 A	A1
(a)(ii)	V=IR in any form OR (R =) V/I OR P=V^2/R in any form OR (R =) V^2 / P	C1
	(R = 6.0 / 1.5 =) 4.0 Ω or (R = 36 / 9.0 =) 4.0 Ω	A1
(b)(i)	resistance of wire is greater (than at X) OR current is less OR p.d. across lamp is less	B1
(b)(ii)	(for normal brightness of lamp,) resistance of circuit (= 12 / 1.5) = 8.0 Ω	C1
	resistance of wire = (8.0 – 4.0 =) = 4.0 Ω	C1
	(distance AX = 1.0 × 4/5 =) 0.80 m OR (sliding contact is) 0.80 m (from A)	A1
	OR V across AX = 6.0 V	(C1)
	resistance of wire = (6/current from a(i) =) 4.0 Ω	(C1)
	(distance AX = 1.0 × 4/5 =) 0.80 m OR (sliding contact is) 0.80 m (from A)	(A1)
	Total:	**8**

36. 0625_s17_ms_43 Q: 9

(a)	$(I =) \frac{P}{V}$ OR 24 ÷ 6.0 OR 4.0 (A) OR $(R =) \frac{V}{I}$	C1
	6.0 ÷ 4.0	C1
	1.5 Ω	A1
(b)(i)	6.0 V	B1
(b)(ii)	1.5 Ω	B1
(b)(iii)	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ OR $1 ÷ 1.5 = \frac{1}{R_1} + \frac{1}{R_2}$ OR $1 ÷ 1.5 = \frac{2}{R}$	C1
	3.0 (Ω)	A1
(c)	resistance of circuit/parallel pair increases	B1
	current (in lamp) decreases OR less p.d. across lamp	B1
	Total:	9

37. 0625_w17_ms_41 Q: 9

(a)(i)	(3 × 1.5 =) 4.5 V	B1
(a)(ii)	$1 / R = 1 / R_1 + 1 / R_2$ OR $R = 1 / (1 / R_1 + 1 / R_2)$ OR $(R =) R_1R_2 / (R_1 + R_2)$	C1
	Correct substitution of 3 and 6	C1
	$(R =)$ 2.0 Ω	A1
(a)(iii)	$V = IR$ in any form OR $(I =) V / R$ OR 4.5 / 3	C1
	1.5 A	A1
	OR	
	$I_{total} = 4.5 / 2 = 2.25$ A	(C1)
	For 3 Ω, $I = 2.25 \times 6 / 9 = 1.5$ A	(A1)
(b)(i)	Connect ammeter (in wire) from A to B OR from H to G	B1
(b)(ii)	Connect voltmeter (terminals) to A and H OR B and G OR C and D OR E and F	B1

38. 0625_w17_ms_42 Q: 8

(a)	$R_S = R_A + R_B$ in any form OR $(R_S =) R_A + R_B$ OR $(R_S =) 4 + 8$	C1
	$(R_S =)$12 (Ω)	C1
	$(R_P =)1 / (1 / R_S + 1 / R_C)$ in any form OR $(R_P =) R_SR_C / (R_S + R_C)$ OR $(R_P =) 1 / (1 / 12 + 1 / 6)$ OR $(R_P =) (6 \times 12) / 18$	C1
	$(R_P =)$ 4.0 Ω	A1
(b)	V_8 = supply $V \times (8 / 12)$ OR = 24 × (8 / 12)	C1
	$(V_8 =)$ 16 V	A1
	OR alternative route	
	I_8 = supply $V / 12$ OR = 24 / 12 OR = 2 (A)	(C1)
	$(V_8 = 2 \times 8 =)$ 16 V	(A1)