

Question		Expected Answers	Marks	Additional Guidance
1	(a)	resistance = p.d./current	B1	accept voltage instead of p.d.; ratio of voltage to current; voltage per (unit) current not $R = V/I$ or p.d. = current x resistance or p.d. per amp or answer in units or voltage over current
	(b) (i)	6 V	B1	
	(ii)	$R = V/I = 6/0.25$ = 24 (Ω)	C1 A1	ecf (b)(i) 240 V gives 960 Ω award 0.024 Ω 1 mark only (POT error)
	(c) (i)	6 V supply with potential divider 'input' across it and lamp across p.d. 'output' ammeter in series with lamp voltmeter across lamp	B1 B1 B1	accept 0 – 6 V variable supply with lamp across it not variable R in series with supply circuit with no battery present can only score voltmeter mark
	(ii)	non-zero intercept line indicating increasing value of R with current	B1 B1	curve must reach y-axis accept straight line or upward curve
	(iii)	resistivity/resistance of filament wire increases with temperature the temperature of the lamp increases with current/voltage increase more frequent electron-ion/atom collisions/AW increased ion vibrations	B1 B1	accept any two of the four statements accept AW, e.g the lamp heats up because of the current
	(d) (i)	lamps do not light	B1	ignore reasons unless too contrary
		remaining lamps are lit with qualification	B1	qualification could be more dimly or sensible explanation
	(ii)	using resistors in parallel formula to obtain a value of R per unit R per unit = 19.4 Ω or R total = 774 Ω $I = 6/19.4$ or $240/774 = 0.31$ A	C1 C1 A1	eg takes R of bulb = 10 Ω giving R per unit = 9.1 Ω gains first mark only ecf (b)(i)(ii) accept R of resistors = 4000 Ω ; current in chain = 0.06 A; total current = 0.06 + 0.25 = 0.31 A 0.3 A is SF error so gains 2 marks only apply SF error only once in paper
Total question 1			16	

Question		Answer	Marks	Guidance
2	(a)	V is not proportional to I the characteristic/line is a curve/not a straight line	B1 B1	accept statement of Ohm's law for 1 mark not resistance is not constant/AW
	(b) (i)	variable power supply or fixed supply + potential divider ammeter in series with and voltmeter in parallel with lamp	B1 B1	value of power supply not required accept cross or Ω in circle for lamp symbol penalise each extra component connected (up to two)
A A A	(ii)	vary p.d. (across lamp)/current (in circuit) by changing voltage supply/moving contact on the potential divider take/record set of values of V and I	B1 B1 B1	accept increase voltage in steps of 1 V/AW accept as ecf changing variable resistor in series in circuit QWC mark
	(c)	From Fig. 1.1 lamp $I_L = 0.25$ A for R $I_R = 6/20 = 0.30$ A so $I_P = 0.55$ (A)	C1 C1 A1	1 mark for each current; 1 mark for $I_R + I_L$ or $R_L = 6/0.25 = 24 \Omega$; R_s in // gives $R_{tot} = 10.9$; so $I_P = 6.0/10.9 = 0.55$ A
	(d) (straight line through origin and 300,6	B1	
	(ii)	appreciation that p.d.s across both components add to 6 V attempt to find where current is the same in both components $I_S = 0.16$ to 0.17 (A) or $165 \pm 5 \times 10^{-3}$ A or 165 ± 5 mA	B1 B1 B1	accept answers in terms of lines drawn on fig.1.1 or description of using ruler horizontally on graph and adding squares across graph,etc. ecf (d)(i)
		Total	14	

Question			Answer	Marks	Guidance
3	(a)	(i)	$I = 230/(42.5 + 2.5)$ $I = 5.11 \text{ (A)}$	C1 A1	accept 5.1 A
		(ii)	$P = I^2R = 5.11^2 \times 45$ $= 1175.0 \text{ W}$ or use $P = VI$ or $P = V^2/R$ answer given to 3 SF i.e. 1180 (W)	C1 A1 B1	ecf(a)(i) and allow $5.00^2 \times 45 = 1125 \text{ W}$ $5.1^2 \times 45 = 1170 \text{ W}$ give 1 mark for 65.3 W (wires only) or 1110 W (heater only) any follow through answer given to 3 SF gains third mark
		(iii)	6 to 10 A (integer values only)	B1	ecf(a)(i) ; allow 13 A
	(b)		$1180 \times 21 \times 4/1000$ $= 99 \text{ p}$	C1 A1	ecf(a)(ii) allow 99.1(2) or 100 p
	(c)		$R = \rho l/A$ $A = 1.70 \times 10^{-8} \times 9.50/2.50$ $A = 6.46 \times 10^{-8} \text{ (m}^2\text{)}$	C1 C1 A1	select formula mark correct substitution allow correct answer to 2 SF, i.e. $6.5 \times 10^{-8} \text{ (m}^2\text{)}$ special case 2/3 marks for: $l = 4.75 \text{ m}$; $A = 3.23 \times 10^{-8} \text{ (m}^2\text{)}$
A A A	(d)		resistance of wires increases so smaller current (in heater) power dissipation in <u>heater</u> less	B1 B1 B1	N.B. wires can be implied by e.g. A reduces so R increases or lower voltage across heater/greater voltage across wires or power dissipation in wires greater/wires get hotter/melt N.B. any statement implying constant or increased current invalidates second and third marking points
		•	Total	14	