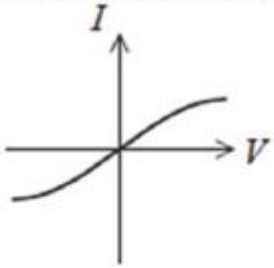
Name of the Student:_____
Max. Marks : 24 Marks **Time : 24 Minutes**

Mark Schemes

Q1.

Question Number	Acceptable answers	Additional guidance	Mark
(i)	• Use of $\rho = \frac{m}{V}$ (1) • $V = 8.1 \times 10^{-6}$ (m^3) (1)	Example of Calculation. $V = \frac{0.043\ \text{kg}}{5300\ \text{kgm}^{-3}}$ $V = 8.1 \times 10^{-6}\ \text{m}^3$	2
(ii)	• Use of $A=\pi r^2$ and $V = Al$ (1) • Use of $R = \frac{\rho l}{A}$ (1) • $R = 2.5\ \Omega$ (ecf from (a)(i)) (1)	Show that value gives 2.50 Ω Example of Calculation. $A = \pi(6 \times 10^{-3}\ \text{mm})^2 = 1.13 \times 10^{-4}\ \text{m}^2$ $8.1 \times 10^{-6}\ \text{m}^3 = (1.13 \times 10^{-4}\ \text{m}^3)\ l$ $l = 0.0716$ m $R = \frac{(4.0 \times 10^{-3}\ \Omega\ \text{m})(0.0716\ \text{m})}{(1.13 \times 10^{-4}\ \text{m}^3)}$ R = 2.54 Ω	3

Q2.

Question Number	Answer	Mark
(a)	Correct curve in + + section (accept $V - I$ or $I - V$ graph but axes must be labelled) **(1)** Symmetrical negative curve (accept if ++ curve incorrect) **(1)**  	**2**
(b)	Drift velocity (of electrons) increases (as current increases) **Or** electrons gain (kinetic) energy (as current increases) **Or** rate of flow of electrons/charge increases (as current increases) **(1)** More (frequent) collisions of electrons with lattice ions **(1)** lattice ion vibrations increased **Or** (More) energy dissipated as heat in lattice **Or** (More) energy transferred when electrons collide with lattice ions **(1)** (accept charge carriers for electrons and atoms/ions/particles for lattice ions.)	**3**
	Total for question	**5**

Q3.

Question Number	Acceptable answers		Additional guidance	Mark
(i)	• Use of $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ to determine the total resistance of the parallel branch	(1)	Example of calculation $\frac{1}{R_{TP}} = \frac{1}{9.7\ \text{k}\Omega} + \frac{1}{45\ \text{k}\Omega}$	
	• $R_{TP} = 8.0\ \text{k}\Omega$	(1)	$R_{TP} = 7.98\ \text{k}\Omega$	
	• Comparison of measured to actual resistance	(1)	MP3: 7.98 kΩ is significantly less than 9.7 kΩ, so unsuitable	
	OR	(1)		
	• Same p.d. across thermistor and voltmeter	(1)		
	• Calculation of ratio of currents	(1)	MP3 dependent on MP2	3
	• States that current through voltmeter is significant			
(ii)	• Current flows through the voltmeter	(1)		
	• But in the new arrangement, the ammeter would read only the current passing through the thermistor **Or** current through ammeter equals current through thermistor	(1)		2

Q4.

Question Number	Answer		Mark
(a)	The (maximum) length is (directly) proportional to the area	(1)	1
(b)(i)	Use of $\rho l/A = R$ $R = 1.34\ (\Omega)$ Example of calculation $R = 1.68 \times 10^{-8}\ \Omega\ \text{m} \times 80\ \text{m} \div 1.0 \times 10^{-6}\ \text{m}^2$ $R = 1.34\ \Omega$	(1) (1)	2

(b)(ii)	Use of $P = I^2R$	**(1)**	
	$P = 160$ W allow ecf from (i)	**(1)**	**2**
	<u>Example of calculation</u> $P = (11\text{ A})^2 \times 1.34\ \Omega$ $P = 162$ W (157 W if they use 1.3 Ω)		
(b)(iii)	Use of $V = IR$ **Or** use of $P = VI$ **Or** use of $P = V^2/R$	**(1)**	
	$V = 15$ V allow ecf from (i) and/or (ii)	**(1)**	**2**
	<u>Example of calculation</u> $V = 11\text{ A} \times 1.34\ \Omega = 14.7$ V (14.3 V if 1.3 Ω is used)		
(c)	To prevent (use of a cable with) resistance that is too large (Accept answers that refer to maintaining or not exceeding a resistance of about 1.3 Ω)	**(1)**	
	Meaning more energy / power / p.d. available for the shredder	**(1)**	**2**
	Total for Question		**9**