

Name of the Student: _____

Max. Marks :18 Marks

Time : 18 Minutes

Mark Schemes

Q1.

Question Number	Acceptable answers	Additional guidance	Mark
	• Use of $\ln V = \ln V_0 - \frac{t}{RC}$ (1) Or Draws initial tangent to curve and uses $T = RC$ Or Determines t when V has decreased to approx. 37% • Conversion hours to seconds (1) • Calculates resistance in range 2.4×10^{11} to $2.8 \times 10^{11} (\Omega)$ (1) • Use of $R = \rho l / A$ (1) • Resistivity in range $2.2 \times 10^{15} \Omega$ to $2.6 \times 10^{15} \Omega \text{ m}$ so yes above $10^{14} \Omega \text{ m}$ (1)	<u>Example of calculation:</u> $\ln 6 = \ln 100 - \frac{20 \times 3600 \text{ s}}{R \times 0.1 \times 10^{-6} (\text{s})}$ $R = 2.6 \times 10^{11} \Omega$ $2.6 \times 10^{11} \Omega = \frac{\rho \times 0.6 \times 10^{-6} \text{ m}}{5.6 \times 10^{-3} \text{ m}^2}$ Resistivity = $2.4 \times 10^{15} \Omega \text{ m}$ Using $T = RC$ $7 \times 3600 \text{ s} = 0.1 \times 10^{-6} \text{ F} \times R$ $R = 2.5 \times 10^{11} \Omega$ (allow T in range 7 – 8 hour)	5

Q2.

Question Number	Answer	Mark
(a)	Use of $R = \rho l/A$ (1) $R = 17 \Omega$ (1) <u>Example of calculation</u> $R = 4.9 \times 10^{-7} \Omega \text{ m} \times 1.0 \text{ m} / 2.9 \times 10^{-8} \text{ m}^2$ $R = 17 \Omega$	2
(b)	Area decreases (1) Resistance inversely proportional to area (1) Or quote $R = \rho l/A$ (1) So this change (also) increases resistance (1) (Accept for 2 nd mark, $I = nAqv$, I decreases if A decreases, $R = V/I$) (Final mark dependent on presenting a logical explanation linking area change and resistance – not just stating increased resistance.)	3
Total for question		5

Q3.

Question Number	Answer	Mark
(a)	$Q = It$ stated (1) A is a unit of current and h is a unit of time (hence Ah is charge) (1) Or use of $Q = It$ with values in A and h (1) Completed by conversion of h to s and use of C (1)	2
(b)	Use of $W = IVt$ (1) $W = 10\,000 \text{ J}$ (1) <u>Example of calculation</u> $W = 0.19 \text{ A} \times 10 \text{ h} \times 1.5 \text{ V}$ $= 0.19 \text{ A} \times 10 \times 60 \times 60 \text{ s} \times 1.5 \text{ V}$ $W = 10260 \text{ J}$	2
(c)	Use of $W = QV$ (1) Energy = 8600 J (1) <u>Example of calculation</u> $W = 7200 \text{ C} \times 1.2 \text{ V}$ $= 8640 \text{ J}$ (lack of J only penalised once in (b) and (c))	2
(d)	Use of efficiency = (output energy/input energy) $\times 100\%$ (1) {It must be their (c) divided by their (b)} Efficiency = 86% (accept 0.86) Use of 10260 J $\rightarrow$ 84% (1) ecf their values from (b) and (c) (Do not award MP2 if efficiency is $>100\%$) <u>Example of calculation</u> Efficiency = $(8640 \text{ J} \div 10000 \text{ J}) \times 100\%$ $= 86\%$	2
Total for question		8