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

Mark Schemes

Q1.

Question Number	Answer	Additional guidance	Mark
(a)(i)	thermionic emission		**(1)**

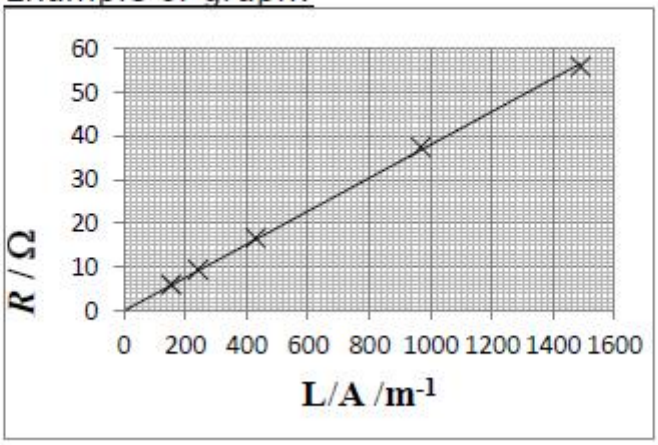
Question Number	Acceptable Answer	Additional guidance	Mark
(a)(ii)	• equate $\frac{1}{2}mv^2$ and VQ (1) • $v = 2.3 \times 10^7$ m s^{-1} (1)	Example of calculation: $E = 1500\text{ V} \times 1.6 \times 10^{-19}\text{ C} = 2.4 \times 10^{-16}\text{ J}$ $v = \sqrt{\frac{2 \times 2.4 \times 10^{-16}\text{ J}}{9.11 \times 10^{-31}\text{ kg}}} = 2.3 \times 10^7$ m s^{-1}	**(2)**

Question Number	Acceptable Answer	Additional guidance	Mark
(b)(i)	• use of $F = EQ$ and $E = \frac{V}{d}$ (1) OR see $F = \frac{VQ}{d}$ • equate $F = ma$ and $F = EQ$ (1)		**(2)**

Question Number	Acceptable Answer	Additional guidance	Mark
(b)(ii)	• use of speed = distance/time (1) • $t = 8.7 \times 10^{-10}$ (s) (1) • use of $a = \frac{VQ}{dm}$ (1) • use of $s = ut + \frac{1}{2}at^2$ (1) with $u = 0$ and vertical acceleration to find s • $s = 3.3 \times 10^{-4}$ m (1)	Example of calculation: $t = \frac{0.02\ \text{m}}{2.3\times10^{7}\ \text{m s}^{-1}} = 8.7 \times 10^{-10}\ \text{s}$ $s = \frac{1}{2} \times \left(\frac{50\ \text{V} \times 1.6 \times 10^{-19}\ \text{C}}{0.01\ \text{m} \times 9.11 \times 10^{-31}\ \text{kg}} \right) \times (8.7 \times 10^{-10}\ \text{s})^2$ $s = 3.3 \times 10^{-4}$ m	**(6)**

Question Number	Acceptable Answer	Additional guidance	Mark
(c)	• use of $V = V_0/\sqrt{2}$ (1) • vertical line (1) • positive and negative deflection shown (1) • maximum deflection 75 V (1)	Example of calculation: $V_0 = 53\ \text{V} \times \sqrt{2} = 75\ \text{V}$	**(4)**

Q2.

Question Number	Acceptable Answer	Additional Guidance	Mark
(a)(i)	• axes and labels (1) • suitable scale (1) • all points plotted correctly (1) • line of best fit drawn (1)	Example of graph: 	**(4)**

(a)(ii)	• attempt to measure gradient using large triangle (1) • ρ = (0.035 – 0.041) Ωm to 2 sf (1)		**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(b)	Two problems identified with solutions from: • taking only one reading could produce an unreliable result (1) • so take repeat readings of length and diameter (1) • metre ruler cannot be used to measure the diameter with sufficient precision (1) OR metre rule can only measure diameter at ends of cylinder • so use Vernier callipers instead (1) • comment about non-uniform shape (1) • so take repeat readings at different positions/ orientations (1)	Accept micrometer giving precision of 0.01 mm for diameter	**(4)**