Name of the Student:_____
Max. Marks : 17 Marks **Time : 17 Minutes**

Mark Schemes

Q1.

Question Number	Acceptable answers	Additional guidance	Mark
	• Use of $\ln V = \ln V_o - \frac{t}{RC}$ **(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 2.8×10^{11} (Ω) **(1)** • Use of $R = \rho l/A$ **(1)** • Resistivity in range 2.2×10^{15} Ω to 2.6×10^{15} Ω m so yes above 10^{14} Ω m **(1)**	Example of calculation: $ln6 = ln100 - \frac{20 \times 3600\ s}{R \times 0.1 \times 10^{-6}(s)}$ $R = 2.6 \times 10^{11}\ \Omega$ $2.6 \times 10^{11}\Omega = \frac{\rho \times 0.6 \times 10^{-6}\ \text{m}}{5.6 \times 10^{-3}\ \text{m}^2}$ 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

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Q2.

Question Number	Answer		Mark
(a)	Weight/W/mg vertically down Tension/T parallel to thread and pointing away Electrical (force) horizontal to left Accept electrostatic (force), repulsive (force), coulomb (force) repelling (force). Do **not** accept just F or drag All three correct 2 marks Any two correct 1 mark The lines must start on the ball and have arrow heads to indicate direction. Minus 1 mark for each extra force line. (Candidates who draw forces on M correctly but also include forces on N score 1)		**2**
(b)(i)	Use of $T \cos 35° = mg$ **Or** $T \sin 55° = mg$ g to kg and × 9.81 Tension = 3.2×10^{-2} (N) Example of calculation $T \cos 35° = mg$ $T = (2.7 \times 10^{-3}\ \text{kg} \times 9.81\ \text{N kg}^{-1}) / \cos 35°$ $T = 0.0323$ N	**(1)** **(1)** **(1)**	**3**
(b)(ii)	Equates electric force to $T \sin 35°$ **Or** $T \cos 55°$ **Or** $W \tan 35°$ **Or** use of pythagoras $F_E = 0.018$ **Or** 0.019 (N) ($F_E = 0.017$ N if show that value used. ecf T from (i) Example of calculation $F_E = 0.032 \times \sin 35°$ $F_E = 0.018$ N	**(1)** **(1)**	**2**
(b)(iii)	Use of $F = Q^2/4\pi\varepsilon_o r^2$ **Or** $F = kQ^2/r^2$ (ecf value of F from (ii) conversion cm to m $Q = (2.9 - 3.1) \times 10^{-7}$ C (candidates who half the value of r can score the first 2 marks) Example of calculation $Q^2 = Fr^2/k$ $Q^2 = (0.020\ \text{N}) \times (20.6 \times 10^{-2}\ \text{m})^2/(8.99 \times 10^9\ \text{N m}^2\ \text{C}^{-2})$ $Q = 3.07 \times 10^{-7}$ C	**(1)** **(1)** **(1)**	**3**
(c)	Both balls would move through the same angle/distance **Or** the balls are suspended at equal angles (to the vertical) (Because) the force on both balls is the same	**(1)** **(1)**	**2**

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