Name of the Student:_____
Max. Marks : 25 Marks **Time : 25 Minutes**

Mark Schemes

Q1.

Question Number	Acceptable answers	Additional guidance	Mark
i	• Number of conduction electrons increases **(1)** • (so) LDR has a lower resistance **(1)** • Ratio of R_{LDR}/R decreases **or** ratio V_{LDR}/V_R decreases **(1)** • (Leading to) decreased pd across motor so speed of motor decreases **(1)**		**4**

Question Number	Acceptable answers	Additional guidance	Mark
ii	**Either** • Use of $R_T = R_1 + R_2$ **(1)** • Uses: ratio of pd across LDR to supply pd = ratio of resistance of LDR to total resistance **(1)** • Number of cells = 8 **(1)** **Or** • Use of $R = \frac{V}{I}$ • Use of $V_s = V_1 + V_2$ **Or** $R_T = R_1 + R_2$ • Number of cells = 8	Example of calculation $V_s = \frac{5\ V\ (270\ \Omega + 193\ \Omega)}{193\ \Omega} = 12\ V$ Number of cells $= \frac{12\ V}{1.5\ V} = 8$	**3**

Q2.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	• Conversion of MeV to J (1) • See $Q_1 = 79 \times 1.6 \times 10^{-19}$ **and** $Q_2 = 2 \times 1.6 \times 10^{-19}$ (1) • Use of $V = \frac{Q}{4\pi\varepsilon_0 r}$ **and** $W = QV$ (1) • $r = 4.1\times10^{-14}$ m (1)	Example of calculation $E_\alpha = 5.5\times10^{6}\text{eV}\times1.6\times10^{-19}\text{J eV}^{-1} = 8.8\times10^{-13}\text{J}$ $8.8\times10^{-13}\text{J} = \frac{79\times1.6\times10^{-19}\text{C}\times2\times1.6\times10^{-19}\text{C}}{4\pi\times8.85\times10^{-12}\text{ F m}^{-1}\ r}$ $r = \frac{3.64\times10^{-26}\text{ N m}^2}{8.8\times10^{-13}\text{ J}} = 4.1\times10^{-14}\text{ m}$	4
(ii)	• Electrons are behaving like waves (1) • wavelength$= \frac{h}{\text{momentum}}$ (1) • Electron wavelength must be similar to the atomic spacing in the foil (1)	MP3: Accept electron wavelength must be similar to the distance between (adjacent) nuclei	3

Q3.

Question Number	Acceptable answers	Additional guidance	Mark
(a)	• V at top/start = 0V **Or** recognition "potential divider" **Or** V increases (by implication) **Or** V at bottom = 1.5V (1) • Two sections of wire act as series resistors **Or** $R=\rho l/A$ **Or** comment about R proportional to length (1) **Or** $\frac{V}{1.5}=\frac{R}{R_T}$ • potential difference proportional to length of wire (1)	**Alternative MS** Constant Current (I) in wire (1) p.d. across section of wire = Ir between A and loop (1) Increases from 0V to 1.5V linearly (1)	3

Question Number	Acceptable answers	Additional guidance	Mark
(b)	• Tangent drawn at 1.5 s (1) • Scales p.d. to give distance (1) • Gradient determined using a base of triangle of at least 1.0 s **Or** use of $s=\frac{(u+v)}{2}t$ **and** correct V read from graph (1) (1) • velocity = 1.0 m s^{-1} – 1.3 m s^{-1}	Example of calculation Gradient = $\frac{1.1\text{V}-0.2\text{V}}{1.0\text{s}}=0.9\text{Vs}^{-1}$ As 1.5 V represents 2.00 m $v=0.9\ \text{Vs}^{-1}\times\frac{2.00\text{m}}{1.5\text{V}}=1.2\ \text{ms}^{-1}$	4

Question Number	Acceptable answers	Additional guidance	Mark
(c)	• Use of $v=u+at$ (1) • Use of $a=g\sin\theta$ (1) • Calculates a value for a, θ or v (using a SUVAT AND $a=g\sin\theta$) (1) • Valid comparison of their calculated quantity and the stated quoted uncertainty. (1)	Example of calculation $1.5\,\text{ms}^{-1}=1.2\,\text{m s}^{-1}+\text{a}\times0.5\,\text{s}$ $a=\frac{0.3\,\text{m s}^{-1}}{0.5}=0.6\,\text{m s}^{-2}$ $0.6\,\text{m s}^{-2}=9.81\,\text{m s}^{-2}\sin\theta$ $\theta=3.6°$	4