

Name of the Student: _____

Max. Marks : 18 Marks

Time : 18 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) $v = 2.3 \times 10^7 \text{ m s}^{-1}$ (1)	<u>Example of calculation:</u> $E = 1500 \text{ V} \times 1.6 \times 10^{-19} \text{ C} = 2.4 \times 10^{-16} \text{ J}$ $v = \sqrt{\frac{2 \times 2.4 \times 10^{-16} \text{ J}}{9.11 \times 10^{-31} \text{ kg}}} = 2.3 \times 10^7 \text{ m s}^{-1}$	(2)

Question Number	Acceptable Answer	Additional guidance	Mark
(b)(i)	- use of $F = EQ$ and $E = \frac{v}{d}$ (1) <u>OR</u> 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)	<u>Example of calculation:</u> $t = \frac{0.02 \text{ m}}{2.3 \times 10^7 \text{ m s}^{-1}} = 8.7 \times 10^{-10} \text{ s}$ $s = \frac{1}{2} \times \left(\frac{50 \text{ V} \times 1.6 \times 10^{-19} \text{ C}}{0.01 \text{ m} \times 9.11 \times 10^{-31} \text{ kg}} \right) \times (8.7 \times 10^{-10} \text{ s})^2$ $s = 3.3 \times 10^{-4} \text{ m}$	(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)	<u>Example of calculation:</u> $V_0 = 53 \text{ V} \times \sqrt{2} = 75 \text{ V}$	(4)

Q2.

Question Number	Answer	Mark
*	(QWC – Work must be clear and organised in a logical manner using technical wording where appropriate) Alternating p.d. max 2 Electric field/ p.d. accelerates particles Or Electric field /p.d. gives particles energy (1) Constant time period Or constant frequency (1) Polarity of dees switches every half cycle Or P.d. switches every half cycle (1) Magnetic field max 2 (1) Magnetic field/force at right angles to particles path (1) Maintains circular motion (whilst in dees) Or Experiences centripetal force/acceleration (whilst in dees) (1) Radius of circle increases as particles get faster (1)	4
	Total for question	4