

Name of the Student: _____

Max. Marks : 27 Marks

Time : 27 Minutes

Mark Schemes

Q1.

Question Number	Acceptable answers	Additional guidance	Mark
	A region where a charged particle experiences a force/acceleration		
	(1)		(1)

Q2.

Question number	Acceptable Answers	Additional guidance	Mark
	At least 4 radial lines	Ignore dotted lines	
	arrow pointing outwards		
	straight, symmetrical and equally distributed		
	(1)		
	(1)		
	(1)		3

Q3.

Question Number	Answer	Mark
(a)	At least three vertical lines spread over symmetrically over more than half of the plate length and touching both plates. (1) (ignore edge ones that might curve) All equispaced and parallel [don't allow gaping to avoid oil drop] (1) Arrow pointing downwards (1)	3
(b)	Negative / - / -ve (1) (negative and/or positive does not get the mark)	1

(c)	Upward force labelled: Electric (force) Or Electrostatic (force) Or force due to electric field Or electromagnetic (force) (1) [do not accept repulsive/attractive force. If EQ used, the symbols must be defined] Downward force labelled: mg, weight, W, gravitational force (1) (for both marks the lines must touch the drop and be pointing away from it. Ignore upthrust if drawn but one mark lost for each extra force added)	2
(d)(i)	$E = 5100 \text{ V} / 2 \text{ cm}$ (1) Conversion of cm to m (1) Use of $QE = mg$ ($1.18 \times 10^{-13} \text{ kg}$) (1) $Q = 4.6 \times 10^{-19} \text{ C}$ (1) ($E = 255\,000 \text{ (V m}^{-1}\text{)}$ scores MP1 & 2. unit conversion missed $\rightarrow Q = 4.62 \times 10^{-17} \text{ C}$ scores MP1 & 3 if V is halved $\rightarrow Q = 9.23 \times 10^{-19} \text{ C}$ scores MP1 ,2 & 3) <u>Example of calculation</u> $E = V/d$ $F = EQ = mg$ $Q = mg / E = mgd/V$ $Q = (1.20 \times 10^{-14} \text{ kg} \times 9.81 \text{ m s}^{-2} \times 0.02 \text{ m}) / (5100 \text{ V})$ $Q = 4.62 \times 10^{-19} \text{ C}$	4
(d)(ii)	Answer to (d)(i) divided by e (1) 3 electrons Or sensible integer number less than 500 (1) (answers with very large numbers of electrons can get MP1 only) <u>Example of calculation</u> Number of electrons = $4.62 \times 10^{-19} \text{ C} / 1.6 \times 10^{-19} \text{ C}$ Number = 2.9 i.e. 3 electrons.	2
Total for question		12

Q4.

Question Number	Answer	Mark
(a)	Arrow(s) downwards (1)	1
(b)	Use of $E = V/d$ (1) Use of $F = EQ$ (1) $F = 5.1 \times 10^{-16} \text{ N}$ (1) <u>Example of calculation</u> $F = (160 \text{ V} \times 1.6 \times 10^{-19} \text{ C}) / 5.0 \times 10^{-2} \text{ m}$ $F = 5.12 \times 10^{-16} \text{ N}$	3

(c)	Between the plates there is an acceleration/force which is vertical/upwards (1) Constant horizontal velocity (1) Outside the plates no (electric) field /force acts (1) Or Outside the plates speed so large that gravitational effect negligible	3
(d)(i)	Release of (surface) electrons due to heating (1)	1
(d)(ii)	Use of $E_k = \frac{1}{2}mv^2$ (1) Use of $V = W/Q$ (1) p.d. = 410 V (1) <u>Example of calculation</u> $E_k = 9.11 \times 10^{-31} \text{ kg} \times (1.2 \times 10^7 \text{ m s}^{-1})^2 / 2$ $E_k = 6.56 \times 10^{-17} \text{ J}$ p.d. = $(6.56 \times 10^{-17} \text{ J}) / (1.6 \times 10^{-19} \text{ C})$ p.d. = 410V	3
	Total for question	11