CAMBRIDGE INTERNATIONAL A LEVEL • PHYSICS 9702

Topical Questions

Unit 18: Electric Fields

Past Papers 2021 – 2025

MARK SCHEME 3 Questions

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Question 1 — Mark Scheme

Question	Answer	Marks
6(a)	work done per unit charge	**B1**
	(work done in) moving positive charge from infinity	**B1**
6(b)	$C = Q / V$	**C1**
	$V = Q / (4\pi\varepsilon_0 r)$ and so $C = Q / [Q / (4\pi\varepsilon_0 r)] = 4\pi\varepsilon_0 r$	**A1**
6(c)	$Q = 4\pi\varepsilon_0 rV \quad = 4\pi \times 8.85 \times 10^{-12} \times 0.13 \times 4500$ $(= 6.5 \times 10^{-8}\ \text{C})$	**C1**
	$(Q - q) / 13 = q / 5.2$	**C1**
	$5.2Q - 5.2q = 13q$, so $q = (5.2 / 18.2)Q$ $q \quad = (5.2 / 18.2) \times 6.5 \times 10^{-8}$ $= 1.9 \times 10^{-8}\ \text{C}$	**A1**
	or	
	$V_T = Q_T / C_T$ $= 6.5 \times 10^{-8} / [4\pi \times 8.85 \times 10^{-12} \times (0.13 + 0.052)]$ $(= 3210\ \text{V})$	**(C1)**
	$q \quad = 4\pi \times 8.85 \times 10^{-12} \times 0.052 \times 3210$ $= 1.9 \times 10^{-8}\ \text{C}$	**(A1)**

Question 2 — Mark Scheme

Question	Answer	Marks
5(a)	from $x = 0$ to $x = r$: horizontal line at $V = 1.0V_0$	**B1**
	from $x = r$ to $x = 3r$: curve with negative gradient of decreasing magnitude starting at $(r, 1.0V_0)$	**B1**
	line passing through $(2r, ½V_0)$ and $(3r, ⅓V_0)$	**B1**

Question 3 — Mark Scheme

Question	Answer	Marks
6(a)	(both have) radial field lines	**B1**
6(b)(i)	**2.1** cm	**B1**
6(b)(ii)	$E = \frac{Q}{4\pi\varepsilon_o r^2}$ e.g. $r = 2.1$ cm, $E = 1.30 \times 10^5$ V m^{-1} $Q = 4\pi\varepsilon_o r^2 E$ $= 4 \times \pi \times 8.85 \times 10^{-12} \times 0.021^2 \times 1.30 \times 10^5$	**C1**
	$= 6.4 \times 10^{-9} C$	**A1**

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Question	Answer	Marks
6(c)	$C = \frac{Q}{V}$ *either* $V = \frac{Q}{4\pi\varepsilon_o r}$ leading to $C = 4\pi\varepsilon_o r$	**C1**
	$C = 4 \times \pi \times 8.85 \times 10^{-12} \times 0.021$	**C1**
	$(C =) 2.3 \times 10^{-12}$ F	**A1**
	or $V = \frac{Q}{4\pi\varepsilon_o r}$ $= \frac{6.4 \times 10^{-9}}{4 \times \pi \times 8.85 \times 10^{-12} \times 0.021}$ $= 2740V$ $C = \frac{6.4 \times 10^{-9}}{2740}$	**(C1)**
	$= 2.3 \times 10^{-12}$F	**(A1)**

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