Electromagnetism: Electric Field and Gauss's Law – Typical Questions

(Set 2: Answers)

A-1	52 s
A-2	$\frac{qE}{k}$
A-3	$\sqrt{\frac{8md}{qE}}$, No
A-4	5 V
A-5	1200 V
A-6	3.6×10^{-3}J
A-7	-80 V (b) -40 V (c) -120 V
A-8	0.016 J, (b) 0.008 J, (c) 0.024 J
A-9	-100 V
A-10	500 V
A-11	(a) $MT^{-3}I^{-1}$ (b) $-A\{\hat{\imath}(y+z)+\hat{\jmath}(z+x)+\hat{k}(x+y)\}$ (c) 35 N/C
A-12	36 J
A-13	200 V/m making an angle 120^0 with the X-axis Radially outward, decreasing with distance as $E = \frac{6}{r^2}\ V/m$
A-14	$\frac{R\lambda}{2\varepsilon_0\sqrt{R^2+x^2}}$ (b) $\frac{R\lambda x}{2\varepsilon_0(\sqrt{R^2+x^2})^3}$
A-15	(a) 20 V (b) 2.65×10^6 m/s (c) 0.50 cm
A-16	(a) $(-)2.0x$ V (b) Points on the plane x = -12.5 m (c) $(100-2.0x)$V (d) Infinity (e) No
A-17	234 J
A-18	0.1 C
A-19	600 m/s

A-20	54 m/s for each particle
A-21	8.5×10^{-26} nm
A-22	(a) 2.0×10^{-8}Cm (b) 1.3×10^8 N/C (c) 180 N/C
A-23	$qd\sqrt{3}$ along the bisector of the angle at $2q$, away from the triangle
A-24	(a) $\frac{q}{4\pi\varepsilon_0 d^2}$ (b) $\frac{p}{4\pi\varepsilon_0 d^3}$ (c) $-\frac{q}{4\pi\varepsilon_0 d^3}$
A-25	$2\pi\sqrt{\frac{ma}{qE}}$
A-26	6×10^{22}
A-27	**(a) $\Delta\phi\|_{Max}$ at $\alpha = 0$ and (b) $\Delta\phi = 0$ at $\alpha = \pm\frac{\pi}{2}$**
A-28	Yes, decreases
A-29	Zero, Yes, Yes
A-30	Zero, No
A-31	No
A-32	Yes
A-33	No, No, No
A-34	(c)
A-35	(a)
A-36	(d)
A-37	(b)
A-38	(a)
A-39	(d)
A-40	(c)
A-41	(d)
A-42	(d)
A-43	All
A-44	(b), (c)
A-45	(a), (c)

A-46	(a), (d)
A-47	(c), (d)
A-48	(b)
A-49	240 Nm^2C^{-1}
A-50	$\frac{Q}{2\varepsilon_0}$
A-51	$-$
A-52	2.2×10^{-12}C
A-53	$\frac{Q}{\varepsilon_0}$
A-54	$\frac{Q}{6\varepsilon_0}$
A-55	1.1×10^4 $Nm^{-2}C^{-1}$
A-56	$\frac{Q}{2\varepsilon_0}$
A-57	3.0×10^5N/C
A-58	(a) 2.32×10^{21} N/C (b) 1.16×10^{21} N/C
A-59	$\frac{Q(x^3-{r_1}^3)}{4\pi\varepsilon_0 x^2({r_2}^3-{r_1}^3)}$
A-60	(a) $-\frac{Q}{4\pi a^2}, \frac{Q}{4\pi a^2}$ (b) $-\frac{Q}{4\pi a^2}, \frac{Q+q}{4\pi a^2}$

	(c) $\frac{Q}{4\pi x^2}$ in both the situation
A-61	(a) 3.4×10^{13} N/C (b) 1.1×10^{12}N/C
A-62	9×10^5 N/C
A-63	2.9×10^{-17} J
A-64	$\frac{\rho x}{2\varepsilon_0}$
A-65	$\frac{\rho x}{\varepsilon_0}$
A-66	0.45 N
A-67	7.7×10^{-7}C/m^2
A-68	0.20 N (b) 0.44 s
A-69	5.03×10^{-13}C/m^2
A-70	(a) Zero (b) $\frac{\sigma}{\varepsilon_0}$ (c) Zero
A-71	(a) $\frac{Q}{2A}$ (b) $\frac{Q}{2A\varepsilon_0}$ towards left (c) $\frac{Q}{2A\varepsilon_0}$ towards right (d) $\frac{Q}{2A\varepsilon_0}$ towards right
A-72	$-\frac{Q}{2}$

—00—