Exercícios Recomendados (Respostas)

Livro: **Princípios de Física - Eletromagnetismo-Volume 3**
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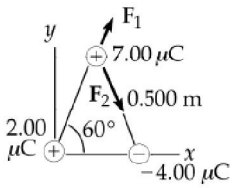
Pioneira Thomson Learning, Inc., tradução da 3ª edição norte-americana.

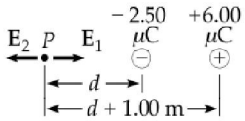
Capítulo 19

6. a) $2.16 \times 10^{-5}\ \text{N}$ b) $8.99 \times 10^{-7}\ \text{N}$

7. $0.872\ \text{N at an angle of } 330°$

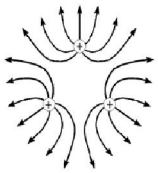


9. $d = 1.82\ \text{m}$ to the left of the -2.50 μC charge.



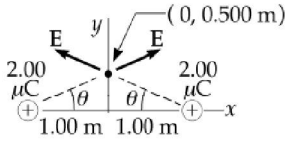
10. a) $\dfrac{-(5.99\times10^{2}\ \text{N/C})\mathbf{i}-(2.70\times10^{3}\ \text{N/C})\mathbf{j}}{}$ b) $(-3.00\,\mathbf{i}-13.5\,\mathbf{j})\ \mu\text{N}$

11. a)



b) $\mathbf{E}=\dfrac{k_e q}{a^2}(\sin 60.0°)\mathbf{j}+\dfrac{k_e q}{a^2}(\sin 60.0°)\mathbf{j}=\boxed{\sqrt{3}\,\dfrac{k_e q}{a^2}\mathbf{j}}$

12. a) $\mathbf{E}=1.29\times10^{4}\,\mathbf{j}\ \text{N/C}$ b) $-3.86\times10^{-2}\,\mathbf{j}\ \text{N}$



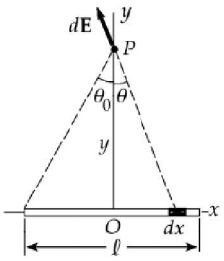
13. a) $5.91\dfrac{k_e q}{a^2}$ at $58.8°$ b) $5.91\dfrac{k_e q^2}{a^2}$ at $58.8°$

15. $E \approx \boxed{\dfrac{(4a)(k_e q)}{x^3}}$

17. $\mathbf{E} = (-2.16 \times 10^7\ \mathbf{i})\ \mathrm{N/C} = \boxed{-21.6\,\mathbf{i}\ \mathrm{MN/C}}$

18. $E = k_e \lambda_0 \int_{x_0}^{\infty} \frac{dx}{x^2} = k_e \left(-\frac{1}{x}\right)\Big|_{x_0}^{\infty} = \boxed{\frac{k_e \lambda_0}{x_0}}$

19. a) $E = 2k_e \lambda y \int_0^{\ell/2} \frac{dx}{(x^2 + y^2)^{3/2}} = \boxed{\frac{2k_e \lambda \sin\theta_0}{y}}$ b) $E_y = \boxed{\frac{2k_e \lambda}{y}}$



22. a) $\frac{q_1}{q_2} = \frac{-6}{18} = \boxed{-\frac{1}{3}}$ b) $\boxed{q_1 \text{ is negative, } q_2 \text{ is positive}}$

24. $\boxed{E = \frac{K}{e\,d}}$

25. a) para baixo. b) $\boxed{3.43\ \mu\mathrm{C}}$

26. a) 111 ns b) 5.67 mm

32. a) $3.20\ \mathrm{MN \cdot m^2/C}$ b) $19.2\ \mathrm{MN \cdot m^2/C}$

c) a resposta do item a mudaria, a do item b não.

33. a) $\boxed{\frac{+Q}{2\epsilon_0}}$ b) $\boxed{\frac{-Q}{2\epsilon_0}}$

34. a) 0 b) $\boxed{365\ \mathrm{kN/C}}$ c) $\boxed{1.46\ \mathrm{MN/C}}$ d) $\boxed{649\ \mathrm{kN/C}}$

36. a) $E = \frac{2k_e \lambda}{r}$ b) E = 0

37. $\boxed{\mathbf{E} = \frac{\rho}{2\epsilon_0} r \text{ away from the axis}}$

41. a) $\sigma = 708\ \mathrm{nC/m^2}$ b) $Q = 1.77 \times 10^{-7}\ \mathrm{C} = \boxed{177\ \mathrm{nC}}$

43. a) $\boxed{80.0\ \mathrm{nC/m^2}}$ b) $\mathbf{E} = \boxed{(9.04\ \mathrm{kN/C})\mathbf{k}}$ c) $\mathbf{E} = \boxed{(-9.04\ \mathrm{kN/C})\mathbf{k}}$

44. a) dentro: $\boxed{-\lambda}$ fora: $\boxed{3\lambda}$ b) $E = \frac{2k_e (3\lambda)}{r} = \frac{6k_e \lambda}{r} = \boxed{\frac{3\lambda}{2\pi\epsilon_0 r}}$

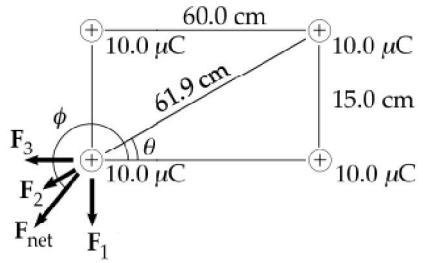
45. a) E = 0 b) $7.99\times10^{7}\ \text{N/C} = \boxed{79.9\ \text{MN/C}}$ c) E = 0 d) $7.34\times10^{6}\ \text{N/C} = \boxed{7.34\ \text{MN/C}}$

49. $$q = \frac{T\sin 15.0^\circ}{E} = \frac{(2.03\times10^{-2}\ \text{N})\sin 15.0^\circ}{1.00\times10^{3}\ \text{N/C}} = 5.25\times10^{-6}\ \text{C} = \boxed{5.25\ \mu\text{C}}$$

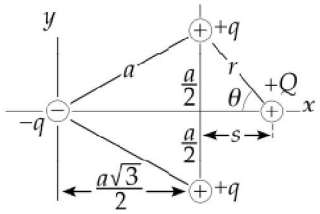
53.

$$F_{net} = \sqrt{F_x^2 + F_y^2} = \sqrt{(-4.78)^2 + (-40.6)^2} = \boxed{40.9\ \text{N}}$$

$$\tan\phi = \frac{F_y}{F_x} = \frac{-40.6}{-4.78} \qquad \phi = \boxed{263^\circ}$$



54. $\boxed{0.939a}$



55. a) $\boxed{\theta_2 = \theta_1}$

57. a) $\boxed{\frac{k_e q^2}{s^2}(1.90)(\mathbf{i}+\mathbf{j}+\mathbf{k})}$ b) $\boxed{3.29\frac{k_e q^2}{s^2}\ \text{away from the origin}}$

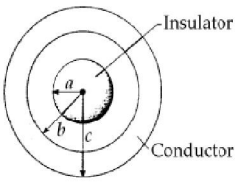
59. a)

$$\oint \mathbf{E}\cdot d\mathbf{A} = E\left(4\pi r^2\right) = q_{in}/\epsilon_0$$

For $r < a$, $q_{in} = \rho\left(\frac{4}{3}\pi r^3\right)$ so $\boxed{E = \frac{pr}{3\epsilon_0}}$

For $a < r < b$ and $c < r$, $q_{in} = Q$ so that $\boxed{E = \frac{Q}{4\pi r^2\epsilon_0}}$

For $b \le r \le c$, $E = 0$, since $\boxed{E = 0}$ inside a conductor.



b) $\sigma_1 = \frac{q_1}{4\pi b^2} = \boxed{\frac{-Q}{4\pi b^2}}$ e $\sigma_2 = \frac{q_1}{4\pi c^2} = \boxed{\frac{Q}{4\pi c^2}}$

60. a) E = 0 b) $\boxed{E = \frac{\sigma}{\epsilon_0}\ \text{toward the right}}$ c) E = 0.

61. a) $E = \boxed{\frac{\sigma}{e_0} \text{ to the left}}$ b) E = 0 c) $E = \boxed{\frac{\sigma}{e_0} \text{ to the right}}$

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3. $\boxed{+46.7\ \text{kV}}$

7. $\boxed{\Delta V = -38.9\ \text{V}}$ The origin is at higher potential.

8. a) 59.0 V b) $\boxed{v_f = 4.55 \times 10^6\ \text{m/s}}$

9. a) $x_{\max} = \boxed{\frac{2QE}{k}}$ b) $x = \boxed{\frac{QE}{k}}$ c) $T = \frac{2\pi}{\omega} = \boxed{2\pi\sqrt{\frac{m}{k}}}$ d) $x_{\max} = \boxed{\frac{2(QE - \mu_k mg)}{k}}$

11. a) F = 0 b) E =0 c) 45.0 kV

12. a) -4.83 m b) 0.667 m e -2.00 m

13. 11MV

14. a) -27.2 eV b) -6.;80 eV c) 0

15. 8.98 J

16. a) 32.2 kV b) $\boxed{-9.65 \times 10^{-2}\ \text{J}}$

17. $\boxed{5.41\frac{k_e Q^2}{s}}$

18. a) nenhum b) $V = \frac{k_e q}{a} + \frac{k_e q}{a} = \boxed{\frac{2k_e q}{a}}$

19. a) v1 = 10.8 m/s v2 = 1.55 m/s b) Maiores

20. a) $v_1 = \boxed{\sqrt{\frac{2m_2 k_e q_1 q_2}{m_1(m_1 + m_2)}\left(\frac{1}{r_1 + r_2} - \frac{1}{d}\right)}}$ e $v_2 = \left(\frac{m_1}{m_2}\right)v_1 = \boxed{\sqrt{\frac{2m_1 k_e q_1 q_2}{m_2(m_1 + m_2)}\left(\frac{1}{r_1 + r_2} - \frac{1}{d}\right)}}$ b) maiores

21. 27.4 fm

23. a) x = 0, V = 10.0 V; x = 3.00 m, V = -11.0 V; x = 6.00 m, V = -32.0 V

b) $E = -\frac{dV}{dx} = -b = -(-7.00\ \text{V/m}) = \boxed{7.00\ \text{N/C in } +x \text{ direction}}$

24. a) E = 0 b) $\boxed{\frac{k_e Q}{r^2}}$

25. 7.0.7 N/C

27. a) $\boxed{\frac{\text{C}}{\text{m}^2}}$ b) $V = k_e\int\frac{dq}{r} = k_e\int\frac{\lambda\,dx}{r} = k_e\alpha\int_0^L\frac{x\,dx}{(d+x)} = \boxed{k_e\alpha\left[L - d\ln\left(1 + \frac{L}{d}\right)\right]}$

28. $V = -\frac{k_e \alpha L}{2} \ln\left[\frac{\sqrt{b^2 + (L^2/4)} - L/2}{\sqrt{b^2 + (L^2/4)} + L/2}\right]$

35. a) 11.1 kV/m b) 98.3 nC/m^2 c) 3.74 pF d) 74.7 pC

37. a) 1.33 microC/m^2 b) 13.3 pF

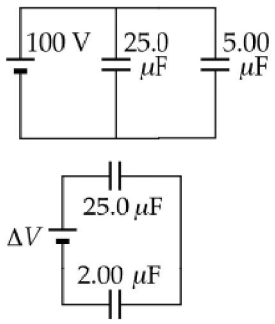
38. a) 2.68 nF b) 3.02 kV

39. $\Delta V = Ed = \frac{mgd\tan\theta}{q}$

43. a) 5.96 microF b) 89.5 microC, 63.2 microC e 26.3 microC

45. Q = 120 microC; Q2 = 40.0 microC; Q1 = 80.0 microC

50. a) 150 J b) 268 V



51. $F = \frac{dU}{dx} = \frac{d}{dx}\left(\frac{Q^2}{2c}\right) = \frac{d}{dx}\left(\frac{Q^2 x}{2\epsilon_0 A}\right) = \frac{Q^2}{2\epsilon_0 A}$

53. 2.51 L

56. 1.04 m

57. 0.188 m^2

58. a) 369 pC b) 118 pF; 3.12 V c) -45.5 nJ

61. $v_f = \sqrt{\frac{2k_e Q^2}{MR}}$

66. a) $\frac{\epsilon_0}{d}\left[\ell^2 + \ell x(\kappa - 1)\right]$ b) $\frac{1}{2}\left(\frac{\epsilon_0(\Delta V)^2}{d}\right)\left[\ell^2 + \ell x(\kappa - 1)\right]$ c) $|F| = \left|-\frac{dU}{dx}\right|$ d) 1.55×10^{-3} N

71. 8kV

Capítulo 21

2. 3.64 h

3. $I = \frac{q}{T} = \frac{q\omega}{2\pi}$

4. a) 17.0 A b) 85.0 kA/m^2

5. a) $\boxed{(0.632)I_0\tau}$ b) $\boxed{(0.99995)I_0\tau}$ c) $\boxed{I_0\tau}$

8. a) 1.82 b) 280 microm

11. a) $\boxed{3.15\times10^{-8}\ \Omega\cdot\text{m}}$ b) $\boxed{6.35\times10^{6}\ \text{A}/\text{m}^2}$ c) $\boxed{49.9\ \text{mA}}$ d) $\boxed{659\ \mu\text{m/s}}$ e) $\boxed{0.400\ \text{V}}$

12. $\boxed{1.71\ \Omega}$

13. E = 0.181 V/m

14. a) n não é afetada b) dobra c) dobra d) não muda

18. 672 s

19. a) 184 W b) 461 oC

20. $\text{Rate} = \left(9.72\times10^{12}\ \text{J/h}\right)\left(\frac{1.00\ \text{kg coal}}{33.0\times10^{6}\ \text{J}}\right) = 2.95\times10^{5}\ \frac{\text{kg coal}}{\text{h}} = \boxed{295\ \frac{\text{metric ton}}{\text{h}}}$

23. a) $R = \boxed{6.73\ \Omega}$ b) $r = \boxed{1.97\ \Omega}$

24. a) $\boxed{4.59\ \Omega}$ b) 8.16 %

25. $I = \boxed{1.17\ \text{A}}$ for 7.00 Ω resistor

a) $\boxed{17.1\ \Omega}$ b) $I = \boxed{0.818\ \text{A}}$ for 10.0 Ω resistor

27. a) $\text{A} = \boxed{227\ \text{mA}}$ b) $V_{ab} = \boxed{5.68\ \text{V}}$

32. $\boxed{I_1 = 0.714\ \text{A}}$, $\boxed{I_2 = 1.29\ \text{A}}$, $\boxed{\mathcal{E} = 12.6\ \text{V}}$

33. $\boxed{I_1 = 846\ \text{mA},\quad I_2 = 462\ \text{mA},\quad I_3 = 1.31\ \text{A}}$

36. $I = \boxed{50.0\ \text{mA flowing from point } a \text{ to point } e}$.

38. a) -61.6 mA b) $\boxed{0.235\ \mu\text{C}}$ c) $\boxed{I_0 = 1.96\ \text{A}}$

39. a) 5.00 s b) $\boxed{150\ \mu\text{C}}$ c) $\boxed{4.06\ \mu\text{A}}$

40. a) 1.5 s b) 1.0 s c) $\boxed{200\ \mu\text{A} + (100\ \mu\text{A})e^{-t/1.00\ \text{s}}}$

41. a) 6.00 V b) 8.29 microsegundos

48. a) $\boxed{8.00\mathbf{i}\ \text{V/m}}$ b) $\boxed{0.637\ \Omega}$ c) $\boxed{6.28\ \text{A}}$ d) $\boxed{200\mathbf{i}\ \text{MA/m}^2}$

e) $\rho\mathbf{J} = \left(4.00\times10^{-8}\ \Omega\cdot\mathrm{m}\right)\left(2.00\times10^{8}\,\mathbf{i}\ \mathrm{A/m^2}\right) = 8.00\mathbf{i}\ \mathrm{V/m} = \mathbf{E}$

49. $\tilde{\rho} = \boxed{1.47\times10^{-6}\ \Omega\cdot\mathrm{m}}$

51. a) 667 A b) 50.0 km

56. a) $\boxed{9.93\ \mu\mathrm{C}}$ b) $\boxed{33.7\ \mathrm{nA}}$ c) $\boxed{334\ \mathrm{nW}}$ d) $\boxed{337\ \mathrm{nW}}$