Chapter 25 Even Answers

2. 6.41×10^{-19} C

4. 46.7 kV

6. (a) -6.00×10^{-4} J (b) -50.0 V

8. (a) 59.0 V (b) 4.55×10^{6} m / s

10. +260 V

12. (a) $2QE/k$ (b) QE/k (c) $2\pi\sqrt{m/k}$

(d) $2\left(QE-\mu_k mg\right)/k$

14. (a) 0.400 m / s (b) The same.

16. (a) 1.44×10^{-7} V (b) -7.19×10^{-8} V

(c) -1.44×10^{-7} V, $+7.19\times10^{-8}$ V

18. (a) –4.83 m (b) 0.667 m and –2.00 m

20. (a) -3.86×10^{-7} J, energy must be added to separate the charges (b) 103 V

22. 8.95 J

24. (a) 32.2 kV (b) -9.65×10^{-2} J

26. (a) no point at a finite distance from the charges (b) $\dfrac{2k_e q}{a}$

28. (a) $v_1=\sqrt{\dfrac{2m_2k_eq_1q_2}{m_1\left(m_1+m_2\right)}\left(\dfrac{1}{r_1+r_2}-\dfrac{1}{d}\right)}$ $v_2=\sqrt{\dfrac{2m_1k_eq_1q_2}{m_2\left(m_1+m_2\right)}\left(\dfrac{1}{r_1+r_2}-\dfrac{1}{d}\right)}$

(b) Faster than calculated in (a).

30. See graphs in Solution section

(a) $\dfrac{V(x)}{k_eQ/a}=\dfrac{2}{\sqrt{(x/a)^2+1}}$ (b) $\dfrac{V(y)}{k_eQ/a}=\left(\dfrac{1}{|y/a-1|}-\dfrac{1}{|y/a+1|}\right)$

32. 7.26×10^{6} m / s

34. $\left(\left(1+\sqrt{\frac{1}{8}}\right)\frac{k_e q^2}{mL}\right)^{1/2}$

36. (a) 10.0 V, –11.0 V, –32.0 V (b) 7.00 N / C in the $+x$ direction

38. (a) 0 (b) $\frac{k_e Q}{r^2}$

40. Inside: $E_x = E_y = E_z = 0$

Outside: $E_x = \frac{3E_0 a^3 xz}{\left(x^2+y^2+z^2\right)^{5/2}}$, $E_y = \frac{3E_0 a^3 yz}{\left(x^2+y^2+z^2\right)^{5/2}}$, $E_z = E_0 + \frac{E_0 a^3\left(2z^2-x^2-y^2\right)}{\left(x^2+y^2+z^2\right)^{5/2}}$

42. –1.51 MV

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

46. $k_e\lambda(\pi + 2\ln 3)$

48. (a) 45.0 MV / m, 30.0 MV / m (b) $V_1 = V_2 = 1.80$ MV

50. Zero charge on the inner sphere, 10.0 μC on the outer sphere.

52. (a) 13.3 μC (b) 0.200 m

54. (a) $\sim 10^4$ V (b) $\sim 10^{-5}$ C

56. (a) $\frac{2k_e Q a^2\left(3x^2-a^2\right)}{\left(x^3-xa^2\right)^2}\,\mathbf{i}$ (b) 609 MN / C

58. 1.45×10^7 m / s

60. (a) 488 V (b) 7.81×10^{-17} J (c) 306 km / s

(d) 3.90×10^{11} m / s^2 (e) 6.51×10^{-16} N (f) 4.07 kN / C

68. $V = k_e\lambda\ln\left(\frac{a+L+\sqrt{(a+L)^2+b^2}}{a+\sqrt{a^2+b^2}}\right)$

70. (a) $E_A > E_B$ since $E = \frac{\Delta V}{\Delta s}$ (b) 200 N / C down (c) See Solution section.

72. $\frac{3}{5}\frac{k_e Q^2}{R}$