Chapter 23 Even Answers

2.   (a) 1.59×10^{-9} N (repulsion)   (b) 1.24×10^{36} times larger   (c) 8.61×10^{-11} C / kg

4. 2.51×10^{-9}

6.   (a) 2.16×10^{-5} N   (b) 8.99×10^{-7} N

8. $0.634d$ from the bead with charge $3q$, stable if third bead has positive charge.

10.   (a) $T = \dfrac{\pi}{2}\sqrt{\dfrac{md^3}{k_e qQ}}$ (b) $4a\sqrt{\dfrac{k_e qQ}{md^3}}$

12. 1.49 g

14. 7.20×10^5 N / C (downward)

16.   (a) $(-599\mathbf{i} - 2700\mathbf{j})$ N / C   (b) $(-3.00\mathbf{i} - 13.5\mathbf{j})\ \mu$N

18.   (a) $1.29 \times 10^4\,\mathbf{j}$ N / C   (b) $-3.86 \times 10^{-2}\,\mathbf{j}$ N

22.   (a) $\dfrac{k_e Qx}{\left(R^2 + x^2\right)^{3/2}}\mathbf{i}$ (b) As long as the charge is symetrically placed, the number of charges does not matter.

24. 1.59×10^6 N / C, directed toward the rod.

26. $-\dfrac{k_e \lambda_0}{2x_0}\mathbf{i}$

30.   (a) 93.6 MN / C; near field approximation is 104 MN / C (about 11% high)

   (b) 0.516 MN / C; point charge approximation is 0.519 MN / C (about 0.6% high)

32. $-\dfrac{2\in_0 mg}{q}$

34.   (a) $\dfrac{k_e Q}{h}\left[\left(d^2 + R^2\right)^{-1/2} - \left((d+h)^2 + R^2\right)^{-1/2}\right]\mathbf{i}$

   (b) $\dfrac{2k_e Q}{R^2 h}\left[h + \left(d^2 + R^2\right)^{1/2} - \left((d+h)^2 + R^2\right)^{1/2}\right]\mathbf{i}$

36.   (a) 2.00×10^{-10} C   (b) 1.41×10^{-10} C   (c) 5.89×10^{-11} C

40.   (a) $-1/3$ (b) $q_1 < 0,\ q_2 > 0$

42.   (a) $\mathbf{a} = -5.76 \times 10^{13} \mathbf{i}$ m/s^2 (b) $\mathbf{v}_i = 2.84 \times 10^6 \mathbf{i}$ m/s   (c) 4.93×10^{-8} s

44. 1.00×10^3 N/C, in the direction of motion.

46.   (a)   downward   (b)   3.43 μC

48.   (a)   12.0 ns   (b)   1.23 mm   (c)   4.24 mm

50.   (a)   24.2 $\mathbf{i}$ N/C   (b)   9.42 N/C at $63.4°$ above the negative x-axis

52.   5.25 μC

54.   (a) $\dfrac{mg}{A\cot\theta + B}$ (b) $\dfrac{mgA}{A\cos\theta + B\sin\theta}$

56.   0.205 μC

58. $Q = 2L\sqrt{\dfrac{k(L - L_i)}{k_e}}$

60.   (a)   171 μs   (b)   0.313 s   (c) shorter

62.   443 kN/C

64. $0.939a$

66.   (a)   0.307 s   (b)   Yes. Ignoring gravity makes a difference of 2.28%

68. $R\left(\dfrac{mg}{k_e\sqrt{3}}\right)^{1/2}$

70.   (b)   in the $\mathbf{k}$ (or $+z$) direction.