Chapter 16

2. 1.8×10^{-6} N
4. a. 2.16×10^{-5} N
   b. 9×10^{-7} N
6. 1.32×10^{-9} kg (?)
8. 5.08 m
10. F_L = 46.8 N, left
    F_M = 157.5 N, right
    F_R = 110.7 N, left
12. 1.38×10^{-5} N, 77.5° below the x-axis
14. a. 8.86×10^{-8} N
    b. 2.23×10^{6} m/s
16. a. 2.75×10^{23} electrons
    b. -4.40×10^{4} C
18. 7.22×10^{-9} C
20. 4.53×10^{-6} C and 5.95×10^{-4} C
22. a. 8×10^{-17} N, westward
    b. 8×10^{-17} N, east
24. 1.42×10^{-8} C
26. a. 1.2×10^{4} N/C toward the 30 nC charge
    b. 3.6×10^{4} N/C toward the 60 nC charge
28. a. 5.58×10^{-11} N/C, down
    b. 1.02×10^{-7} N/C, upward
30. 1.49 g
32. a. 3.2×10^{-16} N, +x-direction
    b. 1.91×10^{11} m/s^2
    c. $5.23 \times 10^{?}$
34. a. 1.28×10^{4} N/C
    b. 4.24×10^{6} m/s
36. 2.76×10^{3} N/C, 77.5° below the x-axis
38. 641 N/C, 86.1° above the x-axis
40. a. center of the triangle
    b. 3.44×10^{5} N/C, upward
42. 1.02×10^{-7} N/C
44. .392 m
46. ?
48. ?
50. ?
52. a. 0 C
    b. 5 μC, -5 μC
    c. 0 C, -5 μC
    d. 0, 5 μC
54. 1.33×10^{-3} C
56. a. 4.8×10^{-15} N
    b. 2.87×10^{12} m/s^2
58. a. 3.83×10^{10} m/s^2
    b. 383 m/s
    c. 1.23×10^{-22} J
60. at y = .853 m
62. a. 1.2×10^{-14} N•m, CCW
    b. 1.04×10^{-14} N•m, CCW
64. 41.8 cm
66. 1.91 kq^2/a^2, at 45° below the x-axis
68. ?
70. ?

Chapter 17

2. ?
4. 1.67×10^{6} N/C
6. a. 1.13×10^{5} V/m
   b. 1.80×10^{-14} N
   c. 4.38×10^{-17} J
8. 1.44×10^{-20} J
10. a. 4×10^{14} N
    b. 2.40×10^{13} m/s^2
12. -.502 V
14. a. 2.65×10^{7} m/s
    b. 6.19×10^{5} m/s
16. a. 1.44×10^{-7} V
    b. -7.2×10^{-8} V
    c. -1.44×10^{-7} V, 7.2×10^{-8} V
18. a. 225 V
    b. 105 V
    c. -135 V, -15 V
20. .546 m, -1.20 m
22. a. 103 V
    b. $-3{,}86 \times 10^{-7}$ J
    c. positive work
24. 2.30×10^{-28} M
26. a. 2.5×10^{4} eV
    b. 2.19×10^{6} m/s
28. 1.13×10^{8} m^2 (43.6 sq mi)
30. 49 V
32. a. 800 V
    b. 1/2
34. C is quadrupled
36. a. 111 μF
    b. 17.8 C
38. a. 9V
    b. Q_1 = 45 μC, Q_2 = 108 μC
40. a. 13,3 μC on each
    b. 20 μC, 40 μC
42. a. 12 V across each, Q_1=60 μC, Q_2 = 48 μC, Q_3 = 108 μC
    b. 21.4 μC on each, V_1 = 4.28 V, V_2 = 5,35 V, V_3 = 2.38 V
44. a. 2 μF
    b. Q_4=16 μC, Q_2=8μC, Q_3=24 μC
    V_4=4 V, V_2=4 V, V_3=8 V
46. 1.83 C
48. a. all connected in parallel
    b. 2 in parallel followed by another 2 in parallel or 2 in series in parallel with another series pair
    c. 1 in series with a group of three in parallel
    d. all four in series
50. a. 12 μF
    b. Q_4 = 144 μC, Q_2 = 72 μC, Q_{24} = Q_8 = 216 μC
52. a. 2.16×10^{-4} J
    b. 5.40×10^{-5} J
54. doubles

Chapter 17 (continued)

56. $W_4 = 3.2 \times 10^{-5}$ J,
$W_2 = 1.6 \times 10^{-5}$ J,
$W_3 = 9.6 \times 10^{-5}$ J
58. a. 4.00 μF
b. ?
c. ?
60. 4
62. a. 1.33×10^{-8} C
b. 2.72×10^{-7} C
64. 3 m, 2×10^{-7} C
66. -7,84 x 10^3 V
68. 3.11 μF
70. 2.40×10^{-5} J
72. .301 m
74. a. 1.73 m^2
b. 3.6 J
76. a. 800 μC
b. 200 V
78. $Q_4 = 1280$ μC,
$Q_6 = 1920$ μC
80. ?

Chapter 18

2. 2.81×10^{20} electrons
4. 9.89 mA
6. 48 C
8. 3.64 h
10. 1.3×10^{-4} m/s
12. a. 4.5×10^{18} electrons/s
b. .72 A
14. 24 Ω
16. .310 Ω
18. .5 A
20. a. .375 A
b. .542 A
22. a. 1.5 Ω
b. 2 A
24. 4.45 m
26. 8.2 m
28. 1.57×10^{-3} Ω•m
30. a. 5.89×10^{-2} Ω
b. 5.45×10^{-2} Ω
32. 25.8 mA
34. -7%
36. 1435°C
38. 67.6°C
40. a. 3.24×10^5 J
b. 1080 s (18 min)
42. 2.7 W
44. 8.67 W
46. 18 bulbs
48. 34.4 Ω
50. 2
52. 768 kg
54. a. 5.04 ¢
b. 71%
56. 48.2 Ω
58. 558 W
60. 8.64×10^5 J
62. 13.5 h
64. 2.24×10^{-5} V
66. ?
68. 2 Ω
70. 37.4 MΩ
72. 256 Ω
74. a. 2.55×10^{-5} Ω
b. 76.5 kg

Chapter 19

2. 5 V
4. three in parallel
6. 1.2 V
8. ?
10. a. .75 A, V_{18}=13.5 V,
$V_6 = 4.5$ V
b. $V_{18} = V_6 = 18$ V
$I_{18} = 1$ A, $I_6 = 3$ A
12. a. 30 V
b. 2.25 V
14. 4.53 V
16. $R_A = 6$ Ω, $R_B = 3$ Ω
18. a. $V_A = 0$ V, $V_B = 10$ V, $V_C = 5$V
b. $V_A = -10$ V, $V_B = 0$ V, $V_C = -5$V
c. $V_A = -5$ V, $V_B = 5$ V, $V_C = 0$ V
20. a. 4.59 Ω
b. .082
22. 30 mA, 12 V
24. .353 A, .118 A, .471 A
26. 5.4 V, point a higher than pt b
28. $I_1 = 3.5$ A, $I_2 = 2.5$ A, $I_3 = 1$ A
30. $V_2 = 3.05$ V, $V_3 = 4.57$ V,
V_4 = ? , V_5 = ?
32. a. 2×10^{-3} s
b. 180 μC
c. .09 A
d. 113 μC
e. 3.33×10^{-2} A
34. 4.1 μA
36. a. 14.6 μC
b. .567 μA
38. a. 91.7 V
b. 27.6 kΩ
c. 75.4 V
40. a. 2 A
b. .113 A
c. 1.97 A
42. $R_x = R_3 \bullet L_1/L_2$
44. a. Toaster: 8.33 A
Heater: 10.8 A
Grill: 12.5 A
b. $I_T = 31.6$ A, 30 A circuit is not sufficient
46. a. 6.25 A
b. 750 W
48. 15.5 A
50. 13 distinct values, ?
52. a. $R_{EQ} = .0999$ Ω, I_1=50 A,
$I_{100}=I_2=I_3=.045$ A
b. $R_{EQ} = 1.09$ Ω, $I_1=I_2=4.55$ A
$I_3 = I_{100} = .05$ A
c. $R_{EQ} = 9.991$ Ω, $I_{100} = .05$ A
$I_1 = I_2 = I_3 = .45$ A

Chapter 19 (continued)

54. a. 1, .5, .5, .3, .2 A
b. 6, 3, 1.2, 1.8, 1.8 V
c. 6, 1.5, .6, .54, .36, 6 W
56. a. 10^{-2} F
b. .414 C
58. $I_1 = 0$ A, $I_2 = I_3 = .5$ A
60. a. 7 Ω
b. $I_8 = 3/8$ A, $I_6 = 4/3$ A
62. a. 14 Ω
b. 56 W
c. 2 W
64. a. .5 A
b. 3 W
c. 1.06 W
66. 12 Ω
68. .39 A, 1.5 V

Chapter 20

2. 1.92×10^{14} m/s^2
4. a. 4.09×10^{-14} T
b. horizontal
6. a. westward
b. no deflection
c. upward
d. downward
8. 806 N
10. a. 7.9×10^{-12} N
b. 0 N
12. ?
14. 7.5 N
16. 8×10^{-3} T, +x-direction
18. a. into the page
b. right
c. bottom of the page
20. .245 T, eastward
22. 1.96 T, out of the page
24. 9.98 N•m, cw (viewed from above the loop)
26. a. .628 N•m
b. 30°
28. 5×10^{-3} Ω
30. 74,960 Ω
32. $R_1 = 2.99 \times 10^4$ Ω, $R_2 = 2.7 \times 10^5$ Ω, $R_3 = 2.7 \times 10^6$ Ω
34. 1.04 cm
36. .885 m
38. ?
40. 1.77 cm
42. a. .208 m
singly charged
.104 m
doubly charged
b. 20.8 cm
44. 4.97×10^{-27} kg
46. 2 cm
48. a. right to left
b. out of the page
c. lower left to upper right
50. a. 4×10^{-6} T, down
b. 6.67×10^{-6} T, 77° left of vertical
52. 5.33×10^{-5} N, toward the other wire
54. 4.5 mm
56. 300 turns
58. ?
60. 1.73×10^{-11} N, positive z-direction
62. 1.74 N•m
64. .109 A, right
66. a. 2.22×10^{-4} A
b. smaller by a factor of 150
68. 1.1×10^{-2} T
70. 1.6×10^{-5} T, toward page top
72. ?
74. .588 T

Chapter 21

2. a. 10^{-7} T•m^2
b. 8.66×10^{-8} T•m^2
c. 0 T•m^2
4. a. 0 T•m^2 (or Wb)
b. 0 Wb
6. 2.96×10^{-6} T•m^2
8. a. ?
b. 0 T•m^2
10. 83.8 mV
12. 160 A
14. 94.2 mV
16. .18 T
18. 2.67 T/s
20. a. 4×10^{-4} T•m^2
b. 1.78×10^{-5} V
22. 272 m
24. 625 m/s (1400 mi/h) This exceeds the normal speed of a plane so the induced voltage will not reach 1.5 V
26. 1 m/s
28. a. 2 nW
b. 2 nW
c. 4×10^{-10} N
d. 2 nW
30. a. cw as viewed from above
b. ccw as viewed from above
32. a. left to right
b. no current is present
c. right to left
34. left to right
36. from top toward bottom
38. ?
40. 1.52 T
42. 3.18×10^{-4} rad/s
44. a. 8A
b. 3.17 A
c. 60 V
46. .64 N•m
48. 19.5 mV

Chapter 21 (continued)

50. a. 1.97 mH
  b. 38.1 A/s
52. 1.92 x 10^{-5} T•m^2
54. ?
56. a. 0 V
  b. 2.22 V
  c. 6 V
  d. 3.78 V
58. 3.01 A
60. a. 18 J
  b. 7.14 J
62. 6.48 x 10^{-2} J
64. 20 mH
66. 2.21 x 10^{-3} C
68. 5.55 x 10^{-4} J
70. a. 1.27 x 10^{-7} J
  b. 2.38 x 10^{-7} J
72. 1/2
74. 3.45 μs
76. (mgR)/(L^2B^2)

Chapter 22

2. 8.49 A, 339 V
4. a. 192 Ω
  b. 144 Ω
6. 6.76 W
8. 20.1 Hz
10. .36 Ω
12. 398 Hz
14. 16.6 μF
16. ?
18. L > 7.03 H
20. a. 12.5 A
  b. .125 A
22. 3.14 A
24. a. .361 A
  b. 18.1 V
  c. 24 V
  d. -53°
26. 2.79 kHz
28. a. 4.68 A
  b. 35.3 V
  c. 93.6 V
  d. 20.7°
30. a. 138 V
  b 104 V
  c. 729 V
  d. 640 v
32. 1.88 V
34. a. 653 mA
  b. 1.44 H
36. a. 1.94 A
  b. 149 V
38. a. .627
  b. .69 A
  c. 4.22 W
40. .492, 48.3 W
  b. .404, 32.6 W
42. a. 24.1 Ω
  b. 31.9 Ω
  c. 867 W
44. a. 179 Ω
  b. .709 H
46. a. .5, 6.32, 2.35, .225 mA
  b. 89.2°, -79.7°, 86.2°, 89.6°
  c. 212 Hz
48. 2.05 MHz, 146 m
50. 18.9 pF to 930 pF
52. a. 480 W
  b. .192 W
  c. .03 W
  d. .192 W
  e. .03 W

The power delivered is maximum when the frequency of the source equals the resonant frequency of the circuit.

54. a. 59 Hz
  b. 5.9 Hz
56. a. 100 turns
  b. 6 A
58. a. 1110 kW
  b. 309 A
  c. 8.33 x 10^3 A
60. a. .155 A
  b. 57 V
  c. 7.22 W
62. a. 28.1 μF
  b. 0 V
64. a. .116 A
  b. 1.38 A
  c. (a) 1.08 W
    (b) 151 W
66. a. 15 turns
  b. 9 V, all 15 turns
    6 V, 10 turns
    3 V, 5 turns
68. .429 A
70. 1.72 ¢
72. 41.1 Hz
74. a. 2.65 cm, 26.5 turns
  b. 9.41 x 10^{-5} H
  c. .108 Ω
  d. 176 A
76. a. 2.9 x 10^4 W
  b. .0058
  c. ?
78. ?

Chapter 23

2. 75 MHz
4. ?
6. 29.8 W/m^2
8. 3.74 x 10^{26} W
10. a. .949 N/C
  b. .0949 N/C
  c. 9.49 x 10^{-3} N/C
12. a. 10^{14} Hz
  b. north and south in a horizontal plane
14. 2.32 x 10^{10} J
16. 720 J
18. a. 300 m (AM)
  b. 3 m (TV, FM)
  c. 3 cm (microwave)
  d. 30 microns (infrared)
  e. 300 nm (ultraviolet)
  f. 3 nm (x-rays)
  g. .003 angstroms (gamma rays)
20. 5.45 x 10^{14} Hz
22. a. 6.25 x 10^{14} Hz
  b. 480 nm
24. a. 3.33 x 10^{-4} s
  b. 11.5 cm
26. 7.71 m
28. a. 4 x 10^{-5} s
  b. 2 mm
30. a. 3 x 10^{14} Hz
  b. 3 x 10^{17} Hz
  c. 3 x 10^{18} Hz
32. ?
34. 3.79 x 10^{16} m
36. 5.16 m
38. a. 2 x 10^{-8} T
  b. 600 kW
40. 4.47 x 10^{-9} J