Chapter 20

1. a. 2f
   b. f/4
   c. f/9
   d. 4f
   e. 3f/4
2. 250 electrons
3. a. 5.19×10^{22} atoms
   b. 1.45×10^{24} electrons
   c. -2.32×10^{5} coulombs
4. a. 1.6×10^{20} electrons
   b. 4.8×10^{-3} g
5. -5.4×10^{7} C
6. 1.0×10^{-8} N
7. 83 N, toward B,
   83 N, toward A
8. 90 N, toward the other
9. 5.6×10^{2} N
10. .20 m
11. 1.5×10^{-14} m
12. .70 m
13. 3.2×10^{-19} C
14. a. 8.2×10^{-8} N
    b. 3.6×10^{-47} N
    c. $F_{Gravity}$ is weaker
15. -98 N, south
16. a. 13 N, right
    b. 41 N, left
17. 180 N
18. a. 370 N, away,
    92 N, toward
    b. ? c. ?
19. a. 9.8×10^{-3} N
    b. 5.7×10^{-3} N
    c. 2.4×10^{-8} C

Chapter 21

1. 2×10^{4} N/C
2. 7×10^{-5} C
3. 4.4×10^{-7} C
4. a. downward
   b. 2.4×10^{-17} N
   c. billion times smaller
5. a. 1.6×10^{-14} N,
   opposite the field
   b. 1.8×10^{111116} m/s^2,
   opposite the E-field
6. a. 1.2×10^{13} N/C,
   outward
   b. -1.9×10^{-6} N,
   toward the nucleus
7. ? 8. ?
9. 4.0×10^{-3} N
10. 120 V
11. 1.4 J
12. -8.00×10^{-17} J
13. 100 C
14. 360 V
15. 120 V
16. 2500 N/C
17. a. 1.6×10^{-18} C
    b. 10 electrons
18. 1.63×10^{-19} C
19. 2.00 μF
20. 500 V
21. 1.13×10^{-9} C
22. .450 J
23. a. .02 W
    b. 4.5 kW
    c. Power is inversely proportional to time.
24. a. 3.1×10^{6} J
    b. 3.1×10^{14} W
    c. 3.1×10^{3} s

Chapter 22

1. 960 W
2. 140 W
3. a. 60 W
   b. 1.8×10^{4} J
4. a. 2500 J/s
   b. 2500 W
5. 18.2 A
6. a. 4.5 W
   b. 3000 J
7. 1.08×10^{5} J, 9.5×10^{4} J b. 8° C
8. 24 V
9. 6 V
10. 120 V
11. 5 A
12. 1.5 A
13. 48 mA
14. a. 100 V
    b. 20 mA
    c. .68 W
15. a. no
    b. .4 W
    c. .68 W
16. a. R = 143, 148, 150, 154,
    154, 143, 143, 154, 157, 156Ω
    b. ?
    c. Nichrome doesn't obey Ohm's law for 8 to 10 V and -2 to -4 V.
17. a. 300 Ω
    b. 60 Ω
    c. 2 A
18. a. 32 Ω
    b. 120 A
    c. No
19. 2 A, ?
20. 28 V, ?
21 .15 A
22. a. 34 W
    b. 2×10^{4} J
23. 2.2×10^{4} J
24. a. 2.5 A
    b. 2.3×10^{4} J
25. 1.2×10^{6} J
26. a. 5 A
    b. 39%
27. a. $6.70
    b. 1¢
28. a. 30 A
    b. 1.1×10^{6} J
    c. 13° C
    d. $4.40
29. a. 9×10^{5} J

Chapter 23

1. a. 25 Ω
   b. 2 A
   c. 40 V, 10 V
   d. 80 W, 20 W
2. 2 V
3. a. 60 Ω
   b. .2 A
4. a. 60 Ω
   b. 6 V
5. a. 1.5 A
   b. 20 Ω
6. a. 230 Ω
   b. 13 Ω
   c. 3.6 W
7. a. 220 Ω
   b. 66 W
   c. It increased!
8. a. .625 A
   b. 192 Ω
   c. 208 Ω
9. a. 57.6, 62.4 V
   b. 17.3 W
   c. 18.7 W
10. 66 Ω
11. 200 Ω
12. a. 52.4 Ω
   b. 115 V
   c. 9.8 Ω
   d. 96 V
13. 6 V
14. a. 8.89 Ω
   b. 4.5 A
   c. 2.5 A
15. a. ?
   b. 1000 s
16. a. 2 A
   b. 3 A
   c. 15 A
   d. yes
17. I_1=2.25 A, V_1=22.5 V
   I_2=.75 A, V_2=V_3=22.5 V
18. P_1=50.6 W, P_2=16.9 W
19. a. 240 Ω
   b. .5 A
   c. 60 W
   d. .25 V
20. a. 6.4 Ω
   b. 19 A
   c. 9.5 V
   d. 110 V, yes this would cause momentary dimming

Chapter 24

1. .04 T
2. a. ?
   b. no
3. ?
4. ?
5. a. into the page
   b. out of the page
6. down
7. The B-Field is perpendicular to the plane of the coil.
8. .10 T
9. 2.4 N
10. .45 N
11. .83 N
12. 7.2 mA
13. 3 kA
14. .60 m
15. a. .011 N/m
   b. north
   c. no
16. 5.7 N
17. a. 3.2 N
   b. 2.3 N
   c. 0 N
18. a. 200 kΩ
   b. 199 kΩ
19. a. .05 V
   b. 5 Ω
   c. 5 Ω
20. 2.4 x 10^{-14} N
21. 2.4 x 10^{-12} N
22. 2.6 x 10^{18} m/s^2
23. 2.1 x 10^{-12} N, upward
24. a. 4.8 x 10^{-13} N
   b. 3.1 m
25. a. from P_2 to P_1
   b. 8.4 x 10^7 m/s
   c. clockwise (cw)
26. .742 T
27. 2.66 x 10^{16} m/s^2
28. 4.2 x 10^6 m/s
29. 2 charges

Chapter 25

1. 9 V
2. 40 V
3. .89 V
4. a. 3.6 V
   b. .33 A
5. 17 mA
6. 2.3 μA
7. a. .039 T
   b. .23 V
8. .0050 T
9. 20 m/s
10. 399 V
11. a. 106 V
   b. 21.2 A
   c. 2.25 kW
12. a. 340 V
   22 A
13. a. 441 MW, input
   b. 4.41 x 10^8 J/s
   c. 2 x 10^6 kg/s
14. a. 781 turns
   b. 44 turns
   c. 7.5 turns
15. a. 18 kV
   b. 30 A
   c. 3.6 kW, 3.6 kW
16. a. 36 turns
   b. 9.4 mA
17. a. 1 to 200
   b. .200 A
18. a. 2 to 1
   b. 5 A
19. a. 125 kV
   b 95 mA
20. a. step up
   b. 10 to 3
21. 300 turns
22. 72 V

Chapter 26

1. 2 x 10^8 m/s
2. .16 T
3. 50 μT
4. 7 x 10^6 m/s
5. a. 1.4 x 10^7 m/s
   b. 5.6 x 10^4 N/C
6. 6.4 x 10^{-14} J
7. 9.6 x 10^{-3} m
8. .047 m
9. a. 1.5 x 10^7 m/s
   b. 7.4 x 10^{-13} J
   c. 2.3 MV
10. 3.9 x 10^{-26} kg
11. .1 m
12. 4.5 x 10^{-3} T
13. 3.9 x 10^{-26} kg
14. 34 units
15. 1/2000 of 1%
16. a. 1.6 x 10^{-15} J
   b. 6.1 x 10^{17} Hz
17. a. 3.5 m
   b. 1.8 m
18. The antenna is 1 cm long.