Chapter 19

Problems & Exercises

1.

42.8

4.

1.00×10^5 K

6.

(a) 4×10^4 W

(b) A defibrillator does not cause serious burns because the skin conducts electricity well at high voltages, like those used in defibrillators. The gel used aids in the transfer of energy to the body, and the skin doesn't absorb the energy, but rather lets it pass through to the heart.

8.

(a) 7.40×10^3 C

(b) 1.54×10^{20} electrons per second

9.

3.89×10^6 C

11.

(a) 1.44×10^{12} V

(b) This voltage is very high. A 10.0 cm diameter sphere could never maintain this voltage; it would discharge.

(c) An 8.00 C charge is more charge than can reasonably be accumulated on a sphere of that size.

15.

(a) 3.00 kV

(b) 750 V

17.

(a) No. The electric field strength between the plates is 2.5×10^6 V/m, which is lower than the breakdown strength for air (3.0×10^6 V/m).

(b) 1.7 mm

19.

44.0 mV

21.

15 kV

23.

(a) 800 KeV

(b) 25.0 km

24.

144 V

26.

(a) 1.80 km

(b) A charge of 1 C is a very large amount of charge; a sphere of radius 1.80 km is not practical.

28.

-2.22×10^{-13} C

30.

(a) 3.31×10^{6} V

(b) 152 MeV

32.

(a) 2.78×10^{-7} C

(b) 2.00×10^{-10} C

35.

(a) 2.96×10^{9} m/s

(b) This velocity is far too great. It is faster than the speed of light.

(c) The assumption that the speed of the electron is far less than that of light and that the problem does not require a relativistic treatment produces an answer greater than the speed of light.

46.

21.6 mC

48.

80.0 mC

50.

20.0 kV

52.

667 pF

54.

(a) 4.4 µF

(b) 4.0×10^{-5} C

56.

(a) 14.2 kV

(b) The voltage is unreasonably large, more than 100 times the breakdown voltage of nylon.

(c) The assumed charge is unreasonably large and cannot be stored in a capacitor of these dimensions.

57.

0.293 F

59.

3.08 µF in series combination, 13.0 µF in parallel combination

60.

2.79 µF

62.

(a) –3.00 µF

(b) You cannot have a negative value of capacitance.

(c) The assumption that the capacitors were hooked up in parallel, rather than in series, was incorrect. A parallel connection always produces a greater capacitance, while here a smaller capacitance was assumed. This could happen only if the capacitors are connected in series.

63.

(a) 405 J

(b) 90.0 mC

64.

(a) 3.16 kV

(b) 25.3 mC

66.

(a) 1.42×10^{-5} C, 6.38×10^{-5} J

(b) 8.46×10^{-5} C, 3.81×10^{-4} J

67.

(a) 4.43×10^{-12} F

(b) 0.452 V

(c) 4.52×10^{-10} J

70.

(a) 133 F

(b) Such a capacitor would be too large to carry with a truck. The size of the capacitor would be enormous.

(c) It is unreasonable to assume that a capacitor can store the amount of energy needed.