69. The power supply for a pulsed nitrogen laser has a 0.050-μF capacitor with a maximum voltage rating of 30 kV. (*a*) Estimate how much energy could be stored in this capacitor. (*b*) If 12% of this stored electrical energy is converted to light energy in a pulse that is 8.0 microseconds long, what is the power of the laser pulse?

70. In lightning storms, the potential difference between the Earth and the bottom of the thunderclouds can be as high as 35,000,000 V. The bottoms of the thunderclouds are typically 1500 m above the Earth, and can have an area of 110 km^2. Modeling the Earth–cloud system as a huge capacitor, calculate (*a*) the capacitance of the Earth–cloud system, (*b*) the charge stored in the "capacitor," and (*c*) the energy stored in the "capacitor."

71. In a photocell, ultraviolet (UV) light provides enough energy to some electrons in barium metal to eject them from a surface at high speed. See Fig. 17–33. To measure the maximum energy of the electrons, another plate above the barium surface is kept at a negative enough potential that the emitted electrons are slowed down and stopped, and return to the barium surface. If the plate voltage is −3.02 V (compared to the barium) when the fastest electrons are stopped, what was the speed of these electrons when they were emitted?

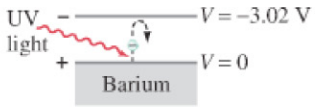

FIGURE 17–33 Problem 71.

72. A +33 μC point charge is placed 36 cm from an identical +33 μC charge. A −1.5 μC charge is moved from point a to point b in Fig. 17–34. What is the change in potential energy?

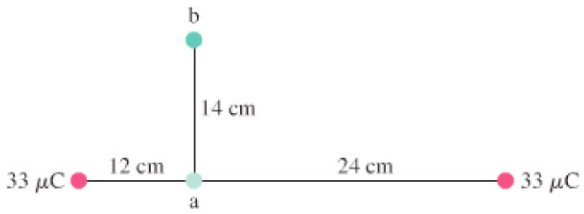

FIGURE 17–34 Problem 72.

73. A capacitor is made from two 1.1-cm-diameter coins separated by a 0.15-mm-thick piece of paper ($K = 3.7$). A 12-V battery is connected to the capacitor. How much charge is on each coin?

74. A +4.5 μC charge is 23 cm to the right of a −8.2 μC charge. At the midpoint between the two charges, (*a*) what are the potential and (*b*) the electric field?

75. A parallel-plate capacitor with plate area 2.0 cm^2 and air-gap separation 0.50 mm is connected to a 12-V battery, and fully charged. The battery is then disconnected. (*a*) What is the charge on the capacitor? (*b*) The plates are now pulled to a separation of 0.75 mm. What is the charge on the capacitor now? (*c*) What is the potential difference across the plates now? (*d*) How much work was required to pull the plates to their new separation?

76. A 2.5-μF capacitor is fully charged by a 6.0-V battery. The battery is then disconnected. The capacitor is not ideal and the charge slowly leaks out from the plates. The next day, the capacitor has lost half its stored energy. Calculate the amount of charge lost.

77. Two point charges are fixed 4.0 cm apart from each other. Their charges are $Q_1 = Q_2 = 5.0\,\mu C$, and their masses are $m_1 = 1.5$ mg and $m_2 = 2.5$ mg. (*a*) If Q_1 is released from rest, what will be its speed after a very long time? (*b*) If both charges are released from rest at the same time, what will be the speed of Q_1 after a very long time?

78. Two charges are placed as shown in Fig. 17–35 with $q_1 = 1.5\,\mu C$ and $q_2 = -3.3\,\mu C$. Find the potential difference between points A and B.

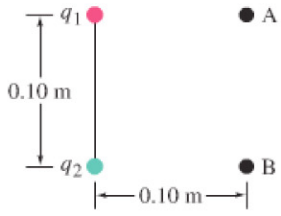

FIGURE 17–35 Problem 78.

Answers to Exercises

A: (*a*) -8.0×10^{-16} J; (*b*) 9.8×10^5 m/s.
B: 0.72 J.
C: 8.3×10^{-9} C.
D: (*a*) 3 times greater; (*b*) 3 times greater.
E: 12 mF.