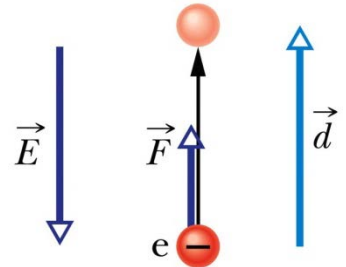


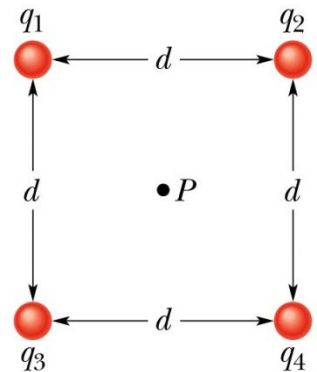
Chapter 19

Example Problems

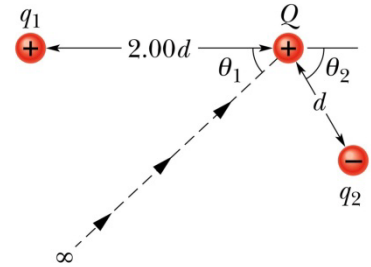
1. Electrons are continually being knocked out of air molecules in the atmosphere by cosmic-ray particles coming in from space. Once released, each electron experiences an electrostatic force F due to the electric field E that is produced in the atmosphere by charged particles already on Earth. Near Earth's surface the electric field has a magnitude $E = 150 \text{ N/C}$ and is directed downward. What is the change in the electric potential energy of a released electron when the electrostatic force causes it to move vertically upward through a distance $d = 520 \text{ m}$?



2. What is the electric potential at point P, located at the center of the square of point charges shown in the figure? The distance $d = 1.3 \text{ m}$ and the charges are $q_1 = +12 \text{ nC}$, $q_2 = -24 \text{ nC}$, $q_3 = +31 \text{ nC}$, and $q_4 = +17 \text{ nC}$.

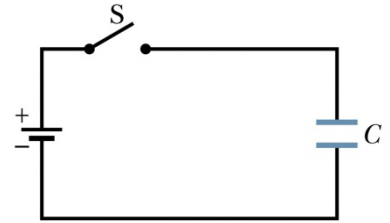


3. How much work must be done to bring a particle of charge $Q = +16e$ and initially at rest, along the dashed line from infinity to the indicated point near two fixed particles of charge $q_1 = +4e$ and $q_2 = -q_1/2$? Distance $d = 1.40$ cm, $\theta_1 = 43^\circ$ and $\theta_2 = 60^\circ$.

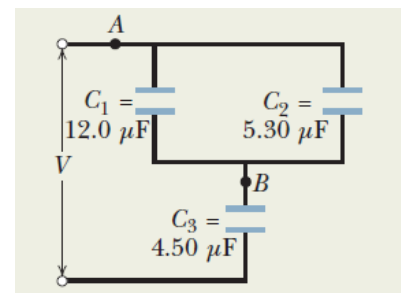


4. Two metal spheres each of radius 3.0 cm, have a center-to-center separation of 2.0 m. Sphere 1 has charge $+1.0 \times 10^{-8}$ C and sphere 2 has charge -3.0×10^{-8} C. Assume that the separation is large enough for us to say that the charge on each sphere is uniformly distributed (the spheres do not affect each other). With $V = 0$ at infinity, calculate the potential at the point halfway between the centers and on the surface of sphere 1.

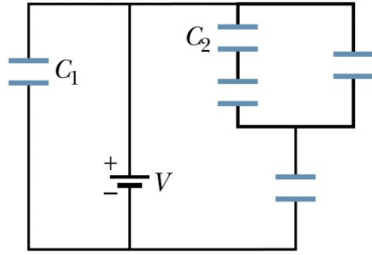
5. The capacitor in the schematic has a capacitance of $25 \mu\text{F}$ and is initially uncharged. The battery provides a potential difference of 120 V . After switch S is closed, how much charge will pass through it?



6. Find the equivalent capacitance for the combination of capacitors shown, across which potential difference V is applied. Find the charge on C_1 if the potential difference applied to the input terminals is $V = 12.5 \text{ V}$.



7. The battery in the schematic has a potential difference of $V = 10.0 \text{ V}$ and the five capacitors each have a capacitance of $10.0 \mu\text{F}$. What is the charge on capacitor 1 and capacitor 2?



8. A parallel-plate air filled capacitor has a capacitance $C = 50.0 \text{ pF}$.
- If each of its plates has an area of 0.35 m^2 , what is the separation between the plates?
 - If the region between the plates is now filled with a material of $\kappa = 5.60$, what is the new capacitance?