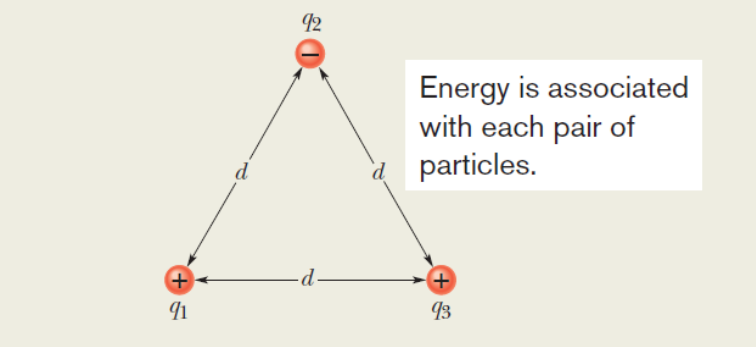
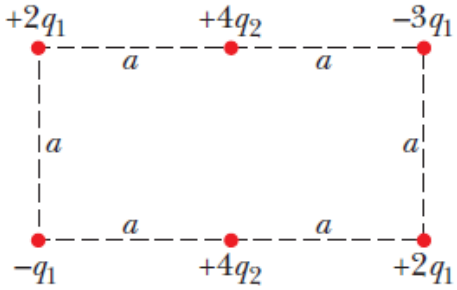
Potential Problems

1. The figure below shows three charged particles held in fixed positions by forces that are not shown. What is the electric potential energy U of this system of charges? Assume that $d = 12cm$ and that $q_1 = +q$, $q_2 = -4q$, and $q_3 = 2q$, in which $q = 150nC$.

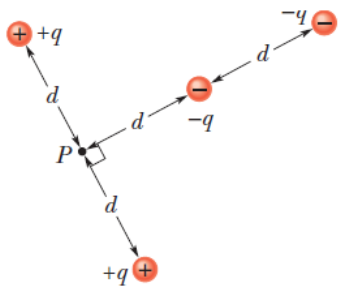


2. An infinite nonconducting sheet has a surface charge density $\sigma = 5.80pC/m^2$. (a) How much work is done by the electric field due to the sheet if a particle of charge $q = 1.60 \times 10^{-19}C$ is moved from the sheet to a point P at distance $d = 3.56cm$ from the sheet? (b) If the electric potential V is defined to be zero on the sheet, what is V at P?

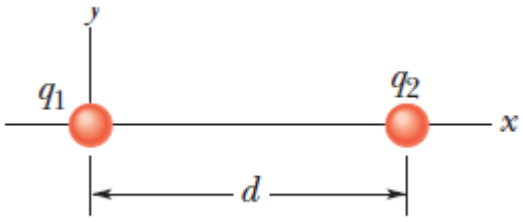
3. The figure below shows a rectangular array of charged particles fixed in place, with distance $a = 39.0cm$, and the charges are shown as integer multiples of $q_1 = 3.40pC$ and $q_2 = 6.00pC$. With $V = 0$ at infinity, what is the net electric potential at the rectangle's center?



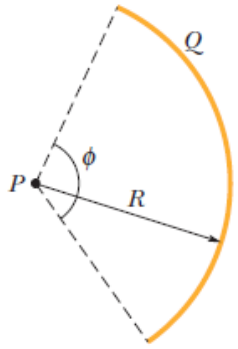
4. In the figure below, what is the net electric potential at point P due to the four particles if $V = 0$ at infinity, $q = 5.00fC$, and $d = 4.00cm$?



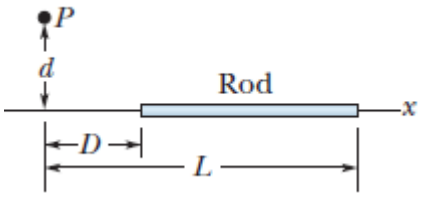
5. In the figure below, particles with the charges $q_1 = 5e$ and $q_2 = -15e$ are fixed in place with a separation of $d = 24.0cm$. With electric potential defined to be $V = 0$ at infinity, what are the finite (a) positive and (b) negative values of x at which the net electric potential on the x-axis is zero?



6. In the figure below a plastic rod having a uniformly distributed charge $Q = 25.6pC$ has been bent into a circular arc of radius $R = 3.71cm$ and central angle $\phi = 120°$. With $V = 0$ at infinity, what is the electric potential at P, the center of curvature of the rod?



7. The figure below shows a thin rod with a uniform charge density of $2.00mC/m$. Evaluate the electric potential at point P if $d = D = L/4.00$. Assume that the potential is zero at infinity.



8. What is the electric field at the point $(3\hat{i} - 2\hat{j} + 4\hat{k})m$ if the electric potential in the region is given by $V = 2xyz^2$, where V is in volts and coordinates x,y,z are in meters?