

[lex187] Electrostatic force between two point charges

Consider two point charges $q_1 = 6\text{nC}$ and $q_2 = 4\text{nC}$ positioned at $\mathbf{x}_1 = (5\hat{\mathbf{i}} - 7\hat{\mathbf{j}} + 9\hat{\mathbf{k}})\text{cm}$ and $\mathbf{x}_2 = (2\hat{\mathbf{i}} + 3\hat{\mathbf{j}} - 7\hat{\mathbf{k}})\text{cm}$, respectively.

(a) Express the electrostatic force acting on particle 1 in the form $\mathbf{F}_1 = F_x^{(1)}\hat{\mathbf{i}} + F_y^{(1)}\hat{\mathbf{j}} + F_z^{(1)}\hat{\mathbf{k}}$ and the electrostatic force on particle 2 in the form $\mathbf{F}_2 = (F_x^{(2)}\hat{\mathbf{i}} + F_y^{(2)}\hat{\mathbf{j}} + F_z^{(2)}\hat{\mathbf{k}})$ with numerical values for all six components in SI units.

(b) Relocate particle 1 to the position $\mathbf{x}'_1 = (x'_1\hat{\mathbf{i}} + y'_1\hat{\mathbf{j}} + z'_1\hat{\mathbf{k}})$ such that it experiences the force $\mathbf{F}'_1 = (-5\hat{\mathbf{i}} + 7\hat{\mathbf{j}} + 8\hat{\mathbf{k}}) \times 10^{-6}\text{N}$. Find the three coordinates x'_1, y'_1, z'_1 in units of cm.

Solution: