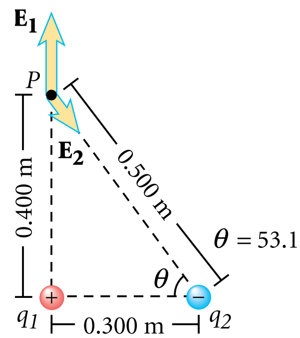
Table 3 Electric Fields	
Examples	***E*, N/C**
in a fluorescent lighting tube	10
in the atmosphere during fair weather	100
under a thundercloud or in a lightning bolt	10 000
at the electron in a hydrogen atom	5.1×10^{11}

Our new equation for electric field strength points out an important property of electric fields. As the equation indicates, an electric field at a given point depends only on the charge, q, of the object setting up the field and on the distance, r, from that object to a specific point in space. As a result, we can say that an electric field exists at any point near a charged body even when there is no test charge at that point. The examples in **Table 3** show the magnitudes of various electric fields.

SAMPLE PROBLEM D

STRATEGY Electric Field Strength



PROBLEM

A charge q_1 = +7.00 μC is at the origin, and a charge q_2 = −5.00 μC is on the x-axis 0.300 m from the origin, as shown at right. Find the electric field strength at point P, which is on the y-axis 0.400 m from the origin.

SOLUTION

1. Define the problem, and identify the known variables.

Given: $q_1 = +7.00\ \mu C = 7.00 \times 10^{-6}$ C $\quad r_1 = 0.400$ m

$q_2 = -5.00\ \mu C = -5.00 \times 10^{-6}$ C $\quad r_2 = 0.500$ m

$\theta = 53.1°$

Unknown: **E** at P ($y = 0.400$ m)

TIP *Apply the principle of superposition. You must first calculate the electric field produced by each charge individually at point P and then add these fields together as vectors.*

2. Calculate the electric field strength produced by each charge.

Because we are finding the magnitude of the electric field, we can neglect the sign of each charge.

$$E_1 = k_C\frac{q_1}{r_1^2} = (8.99 \times 10^9\ \mathrm{N{\bullet}m^2/C^2})\left(\frac{7.00 \times 10^{-6}\ \mathrm{C}}{(0.400\ \mathrm{m})^2}\right) = 3.93 \times 10^5\ \mathrm{N/C}$$

$$E_2 = k_C\frac{q_2}{r_2^2} = (8.99 \times 10^9\ \mathrm{N{\bullet}m^2/C^2})\left(\frac{5.00 \times 10^{-6}\ \mathrm{C}}{(0.500\ \mathrm{m})^2}\right) = 1.80 \times 10^5\ \mathrm{N/C}$$

3. Analyze the signs of the charges.

The field vector $\mathbf{E_1}$ at P due to q_1 is directed vertically upward, as shown in the figure above, because q_1 is positive. Likewise, the field vector $\mathbf{E_2}$ at P due to q_2 is directed toward q_2 because q_2 is negative.