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Holt Physics

Problem 17D

PROBLEM

A typical thundercloud has an electric field of about 3.0×10^5 N/C. If the electric field is directed toward the ground. What is the electric force on an 18 nC charge in this field?

SOLUTION

Given: $E = 3.0 \times 10^5$ N/C $\quad q = 18$ nC $= 1.8 \times 10^{-8}$ C

Unknown: $F_{electric} = ?$

Choose the equation(s) or situation: Use the definition of electric field and rearrange it to solve for $F_{electric}$.

$$E = \frac{F_{electric}}{q}$$

$$F_{electric} = Eq = (3.0 \times 10^5 \text{ N/C})(1.8 \times 10^{-8} \text{ C})$$

$$F_{electric} = \boxed{5.4 \times 10^{-3} \text{ N, directed toward the ground}}$$

ADDITIONAL PRACTICE

1. An electric field of 9.0 N/C is directed along the positive *x*-axis. What is the electric force on a –6.0 C charge in this field?
2. An electric field of 1500 N/C is directed along the positive *y*-axis. What is the electric force on a 5.0 nC charge in this field?
3. Millikan's experiment measures the charge of an electron by suspending charged oil droplets in an electric field. If an oil droplet with a mass of 3.35×10^{-15} kg has the same charge as an electron. What electric force is required to balance the weight of the oil droplet?
4. Two equal charges of 3.00 μC lie along the *x*-axis: one is at the origin, and the other is 2.0 m from the origin. Find the magnitude and direction of the electric field at a point on the *y*-axis 0.25 m from the origin.
5. A charge, $q_1 = 15.0$ μC, is at the origin, and a second charge, $q_2 =$ 5.00 mC, is on the *y*-axis 0.500 m from the origin. Find the magnitude and direction of the electric field at a point on the *y*-axis 1.00 m from the origin.
6. An electric field of 1663 N/C is directed along the positive *x*-axis. If the electric force on a charge is 8.42×10^{-9} N, what is the charge?
7. An electric field of 4.0×10^3 N/C is directed downward. If the electric force on a charge is 6.43×10^{-9} N, what is the charge?

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8. One electron is at the point $(2.00 \times 10^{-10}\ \text{m}, 0\ \text{m})$ and another electron is at the point $(3.00 \times 10^{-10}\ \text{m}, 0\ \text{m})$. If the field point is at the origin, how far from the origin (along the x-axis) could a proton be placed so that the strength of the resultant electric field would be zero?

9. One charge, $q_1 = -9.00$ C, is at the point (1.50 mm, 0 mm). Another charge, $q_2 = 6.00$ C, is at the point (–1.50 mm, 0 mm). If the field point is at the origin, how far from the origin (along the x-axis) could a 3.00 C charge be placed so that the strength of the resultant electric field would be zero?

10. One charge, $q_1 = -55.0$ nC, is at the point $(-5.00 \times 10^{-7}\ \text{m}, 0\ \text{m})$. Another charge, $q_2 = 11.0$ nC, is at the point $(5.00 \times 10^{-7}\ \text{m}, 0\ \text{m})$. If the field point is at the origin, how far from the origin (along the x-axis) could a 5.00 nC charge be placed so that the strength of the resultant electric field would be zero?