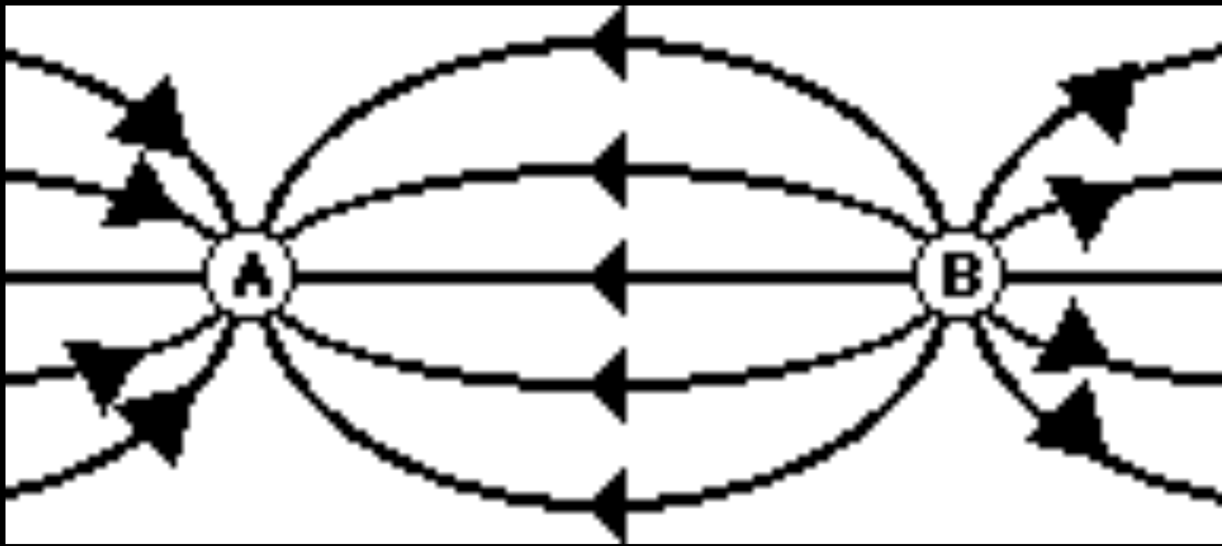
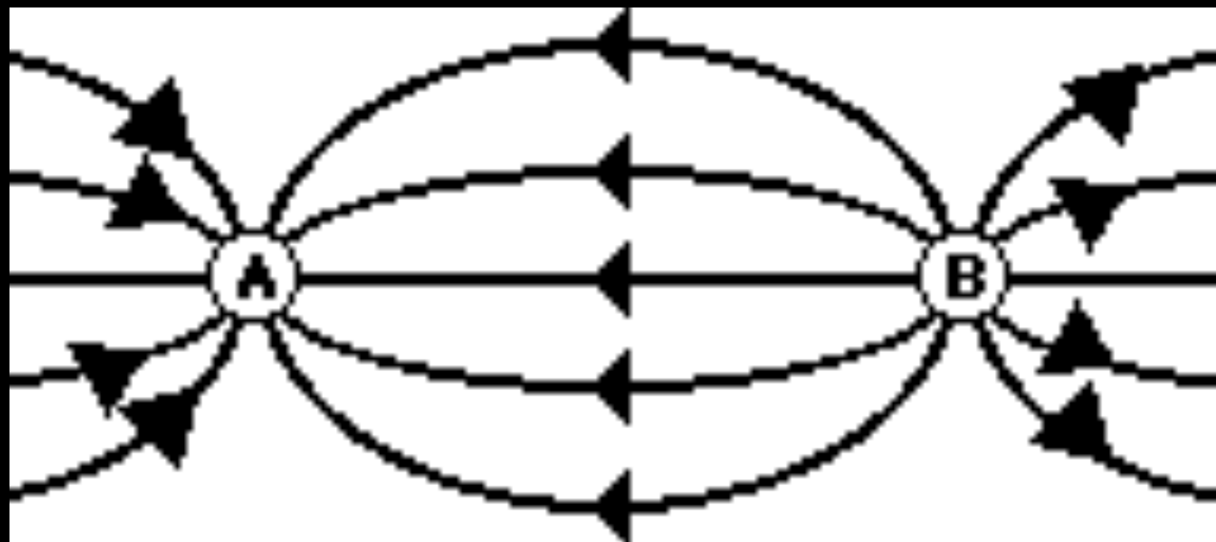
What is the charge of object A and B?



a. I've got my answer

1 min

What is the charge of object A and B?



- Field lines go in to A, so A is negative
- Field lines go away from B, so B is positive

If you place a lightning rod on top of your home but failed to ground it, then it is unlikely that your home would be struck by lightning.

True or False?

a. I’ve got my answer

2 min

False

The elevated lightning rod would draw charge from the cloud to the ground. In the event of a lightning strike, a bolt would likely select a path from the cloud that connects to the rod. If the rod is not grounded, then the charge will pass through the home during its journey to the ground. The intense heat associated with the lightning bolt would cause severe damage and possibly cause an explosion or a fire. In the end, it would have been better to not even have installed a lightning rod than to have installed one that is not grounded.

How far apart must a proton and electron be, if the force between them is -9.5×10^{-3} N?

a. I've got my answer

2 min

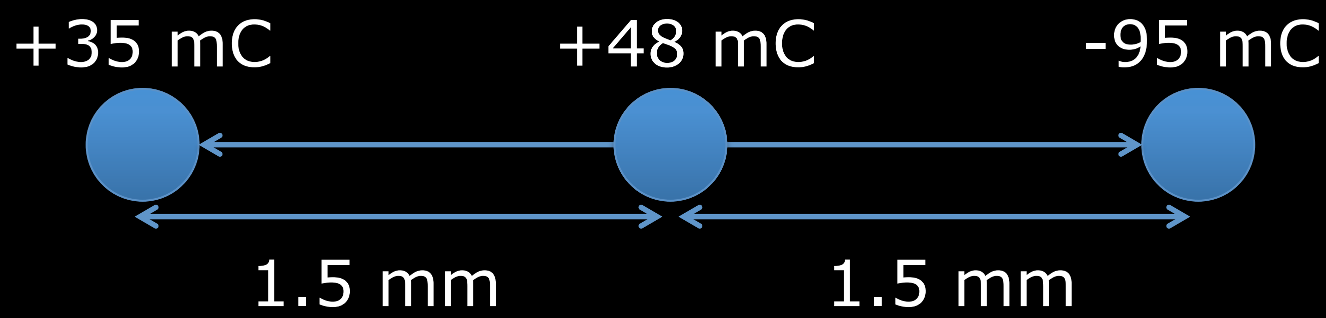
How far apart must a proton and electron be, if the force between them is -9.5×10^{-3} N?

$F = k\, q_1\, q_2 / d^2$

$$-9.5 \times 10^{-3}\ \text{N} = \frac{(9 * 10^{9}\ \text{N m}^2/\text{C}^2)(1.6 * 10^{-19}\ \text{C})(-1.6 * 10^{-19}\ \text{C})}{d^2}$$

$d = 1.56 \times 10^{-13}$ m

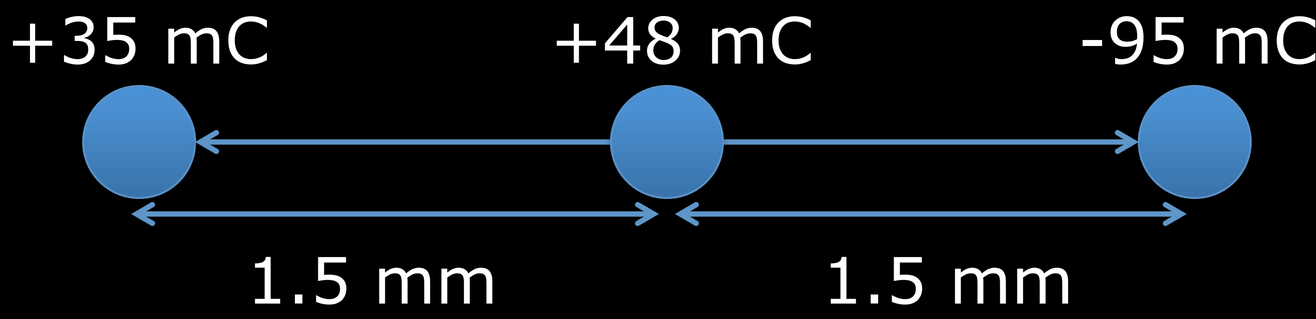
What is the magnitude and direction of the electric force felt by the middle charge?



a. I've got my answer

4 min

What is the magnitude and direction of the electric force felt by the middle charge?



$F = F_{\text{middle \& left charge}} + F_{\text{middle \& right charge}}$

F $= \dfrac{k * (35 * 10^{-3}\ C) * (48 * 10^{-3}\ C)}{(1.5 * 10^{-3}\ m)^2} - \dfrac{k * (-95 * 10^{-3}\ C) * (48 * 10^{-3}\ C)}{(1.5 * 10^{-3}\ m)^2}$

$F = 6.72 \times 10^{12}$ N - -1.82×10^{13} N = 2.49×10^{13} N, pulling the middle charge toward the charge on the right – opposites attract, likes repel. The positive F between the left and middle charges means they are pushing away from each other. The negative F between the middle and right charges means they are pulling towards each other.

A proton in an electric field experiences a force of -3.5×10^{-3} N. What is the magnitude and direction of the electric field at this point?

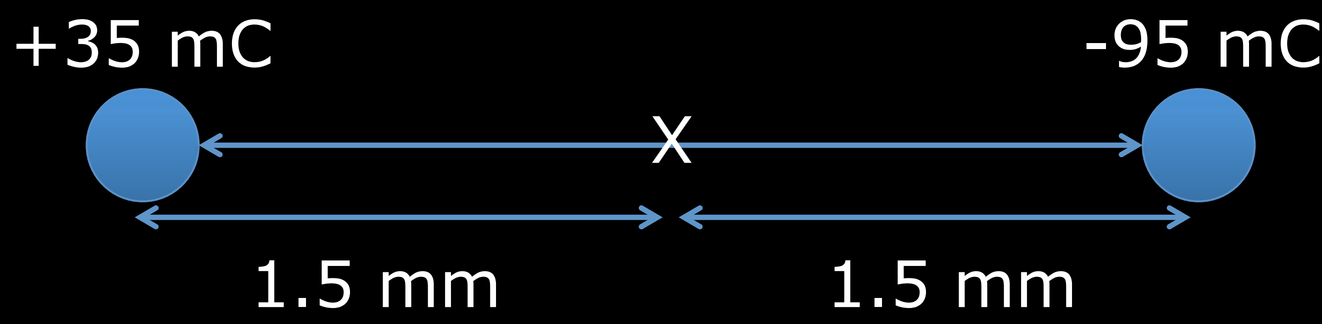
a. I've got my answer

2 min

A proton in an electric field experiences a force of -3.5×10^{-3} N. What is the magnitude and direction of the electric field at this point?

- $E = F/q$
- $E = (-3.5 \times 10^{-3}\ N) / (1.6 \times 10^{-19}\ C)$
- $E = -2.19 \times 10^{16}$ N/C, in the same direction as the force (both point in the "-" direction)

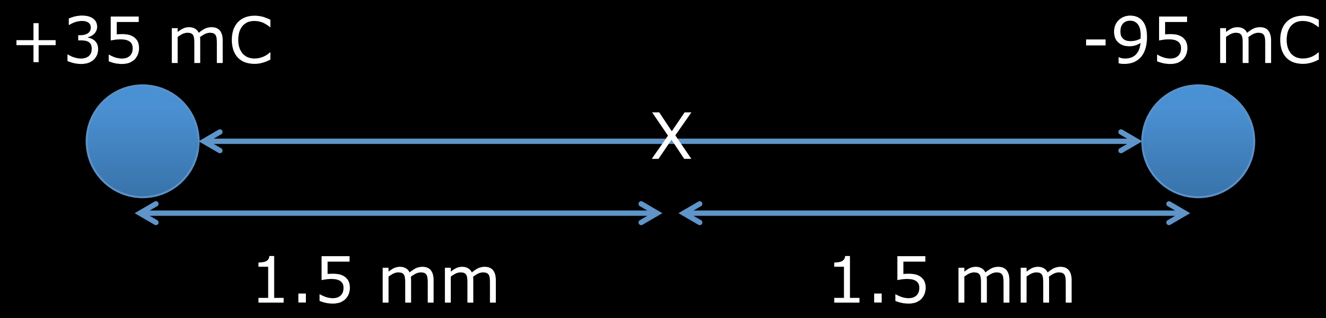
What is the magnitude and direction of the electric field felt by someone standing at the X?



a. I've got my answer

4 min

What is the magnitude and direction of the electric field felt by someone standing at the X?



When calculating the E field, use the absolute value of the charge to find the magnitude of the E field. Then assign a direction depending on which direction the field lines are pointing at your test position (at the X)

$E = E_{\text{left charge}} + E_{\text{right charge}}$

$$\mathbf{E} = \frac{k * (35 * 10^{-3}\ \text{C})}{(1.5 * 10^{-3}\ \text{m})^2} + \frac{k * (95 * 10^{-3}\ \text{C})}{(1.5 * 10^{-3}\ \text{m})^2}$$

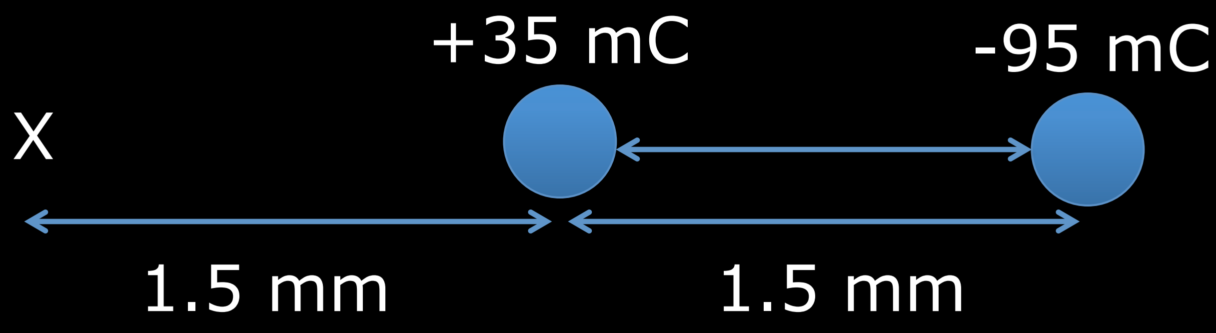
$E_{left} = 1.4 \times 10^{14}$ N/C pointing to the **right** (away from the + charge)

$E_{right} = 3.8 \times 10^{14}$ N/C pointing to the **right** (in to the – charge)

Because they're both pointing in the same direction, the E fields add

$E_{total} = (1.4 + 3.8) \times 10^{14}$ N/C, to the right

Now I've moved the position of X. What is the magnitude and direction of the electric field felt by someone standing at the X?



$E = E_{left\ charge} + E_{right\ charge}$

$$\mathbf{E} = \frac{k * (35 * 10^{-3}\ C)}{(1.5 * 10^{-3}\ m)^2} + \frac{k * (95 * 10^{-3}\ C)}{(3.0 * 10^{-3}\ m)^2}$$

E_{left} = 1.4 x 10^{14} N/C pointing to the **left** (away from the + charge)

E_{right} = 9.5 x 10^{13} N/C pointing to the right (in to the – charge)

Because they're pointing in opposite directions, you subtract the E fields

E_{total} = (1.4 x 10^{14} N/C) – (9.5 x 10^{13} N/C) = 4.5 x 10^{13} N/C, to the left (direction of larger field)

A battery is charged using a current of 1.5 A for 2.0 hr. How much charge passes through the battery?

a. I've got my answer

2 min

A battery is charged using a current of 1.5 A for 2.0 hr. How much charge passes through the battery?

$$I = (n * q) / t$$

$$1.5\ A = \frac{(\mathbf{n} * 1.6 * 10^{-19}\ C)}{(2\ hr * 3600\ sec/1\ hr)}$$

$$\mathbf{n} = \frac{1.5\ A * (2\ hr * 3600\ sec/1\ hr)}{(1.6 * 10^{-19}\ C)}$$

$6.75 * 10^{22}$

What is the current through four 75 Ω resistors arranged in series if the voltage is 220 V?

a. I’ve got my answer

1.5 min

What is the current through four 75 Ω resistors arranged in series if the voltage is 220 V?

$R_{tot} = 4 * 75 = 300\ \Omega$

$V = I R$

$220\ V = \mathbf{I} * 300\ \Omega$

$\mathbf{I} = 220\ V / 300\ \Omega$

0.73 A