Electric Fields

Fields · 4 questions · step-by-step answers at the end

Name: Date: Score: / 4

USEFUL EQUATIONS

$F = Q_1Q_2 / (4\pi\varepsilon_0 r^2)$ $E = F / Q$ $E = V / d$ $E = Q / (4\pi\varepsilon_0 r^2)$ $V = Q / (4\pi\varepsilon_0 r)$

Questions

Show your working in the space under each question.

1. Find the potential 0.10 m from a +2.0 nC point charge. ($1/4\pi\varepsilon_0 = 8.99 \times 10^9$ N m^2 C^{-2})

2. Two parallel plates 2.0 cm apart have 5.0 kV across them. Find the field strength, and the force and acceleration of an electron between them.

3. How much work is done moving a +2.0 µC charge through a potential difference of 500 V?

4. Charges +4Q and +Q are a distance d apart. Where is the field zero?

Step-by-step answers

Electric Fields

1. $V = 8.99 \times 10^{9} \times 2.0 \times 10^{-9}/0.10 =$ **$180\ V$**.

2. 1. $E = V/d = 5000/0.020 =$ **$2.5 \times 10^{5}\ V\ m^{-1}$**.

2. $F = eE = 1.6 \times 10^{-19} \times 2.5 \times 10^{5} =$ **$4.0 \times 10^{-14}\ N$**.

3. $a = F/m = 4.0 \times 10^{-14}/9.11 \times 10^{-31} =$ **$4.4 \times 10^{16}\ m\ s^{-2}$**, toward the positive plate.

Answer: $2.5 \times 10^{5}\ V\ m^{-1}$; $4.0 \times 10^{-14}\ N$; $4.4 \times 10^{16}\ m\ s^{-2}$

3. $W = QV =$ **$1.0\ mJ$**.

4. $4Q/x^{2} = Q/(d - x)^{2}$ gives $x =$ **$2d/3$ from the $+4Q$ charge**.