2 Electric Charge and Electric Fields

1. $E = \frac{kq}{r^2} \rightarrow 2\times10^{-3} = \frac{(8.9\times10^9)q}{10^{-3}} \rightarrow 2\times10^{-9} = 8.9\times10^9(q) \downarrow$

$\frac{2\times10^{-9}}{8.9\times10^9} = q \rightarrow q = 2.25\times10^{-19}$

$E = 2\times10^{-3}$ V/m
$r^2 = 1\times10^{-3}$
$q = 2.25\times10^{-19}$
$k = 8.9\times10^9$

$E_c = \frac{(8.9\times10^9)(2.25\times10^{-19})}{(5\times10^{-3})^2} \rightarrow \boxed{E_c = 8\times10^{-5}\ V/m}$

B. $E = \frac{kq}{r^2}$ $\quad 8\times10^{-3} = \frac{(8.9\times10^9)(1\times10^{-6})}{r^2} \rightarrow r^2 = \frac{(8.9\times10^9)(1\times10^{-6})}{8\times10^{-3}} \downarrow$

$r^2 = 1112500 \rightarrow r = 1054$

$E_1 = 8\times10^{-3}$
$r = 1054$
$q = 1\times10^{-6}$
$k = 8.9\times10^9$

$E_2 = ?$ $\quad E = \frac{(8.9\times10^9)(3\times10^{-6})}{1054^2} \rightarrow \boxed{E = 2.4\times10\ V/m}$
$r = 1054$
$q = 3\times10^{-6}$
$k = 8.9\times10^9$

2. $F = qe \rightarrow q = \frac{F}{e} \rightarrow q = \frac{4\times10^{-15}}{6131.25} \rightarrow q = 6.5\times10^{-19}$

$E_{field} = 6131.25$ N/C
$m = 4\times10^{-16}$
$F = 4\times10^{-15}$
$F = ma$

$\frac{6.5\times10^{-19}}{1.6\times10^{-19}} = 4.077$

A. 4 electrons

B. $q = \frac{F}{E} \downarrow$

$\frac{10^{-15}}{4\times10^{-16}} \downarrow$

B. A = 2.5 N/S

$F_c = qE \rightarrow (4.9\times10^{-19})(6131.25) = 3\times10^{-15}$

$q = (6.5\times10^{-19}) - (1.6\times10^{-19}) = 4.9\times10^{-19}$

$(4\times10^{-15}) - (3\times10^{-15}) = 10^{-15}$

$E = 6131.25$

2.25×10^{-16}

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3 Potential Energy and Capacitors

1. A. $KE = qV$

$q_H = 1.6 \times 10^{-19}$ Hydrogen $= 6.4 \times 10^{-16}$
$q_{He} = 3.2 \times 10^{-19}$ Helium $= 1.28 \times 10^{-15}$ $\rightarrow KE_{tot} = 1.92 \times 10^{-15}$
$V = 4000V$

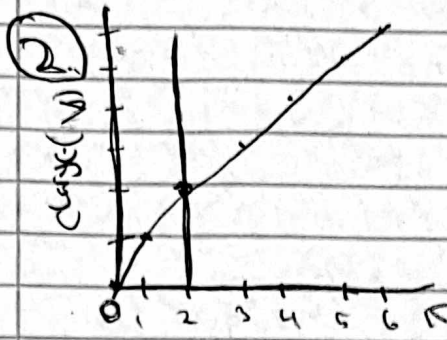
$\frac{1.92 \times 10^{-15}}{1.6 \times 10^{-19}} = \boxed{12000 E/U}$

B. $E = \frac{V}{x}$

$V = 4kV$
$E = ?$
$x = 5cm$

$\frac{4000V}{.05m} = \boxed{8 \times 10^4 V/m}$

2.



Field $= 1kV/m = 1V/mm$ Y intercept $= 0V$

3. $C = \frac{\varepsilon_0 A}{d} \rightarrow C = \frac{(8.85 \times 10^{-12})(10^{-4})}{2 \times 10^{-3}} = \boxed{4.4 \times 10^{-13} F}$

$C = 8.85 \times 10^{-12}$
$A = 1cm$
$d = 2mm$

B- $E = \frac{1}{2} \cdot C \cdot V^2 \rightarrow (4.4 \times 10^{-13}) \cdot .5 \cdot 25 = \boxed{5.5 \times 10^{-12} J}$

4. Parallel

4. Current Resistors and Circuits

① A
$I = \frac{\mathcal{E}_1 + \mathcal{E}_2}{r_1 + r_2 + R_{load}} \rightarrow \frac{1.5+1.5}{2+2+50} = 5.5\times10^{-2}\,A$

$I = 12$
$V = 3$
$\mathcal{E}_1 / \mathcal{E}_2 = 1.5\,V$
$R = 50\,\Omega$

$\frac{\mathcal{E}}{r_{tot} + R_{load}} \rightarrow \frac{1.5}{.5+5+50} = 3\times10^{-2}\,A$

A. Series $= 5.5\times10^{-2}\,A$
Parallel $= 3\times10^{-2}\,A$

B $P = IV$

Series $\rightarrow P = (5.5\times10^{-2})\,3 \rightarrow P = 1.6\times10^{-1}\,W$
Parallel $\rightarrow P = (3\times10^{-2})\,1.5 \quad P = 4.5\times10^{-2}\,W$

②
A. 2 mS
B. 105 mV