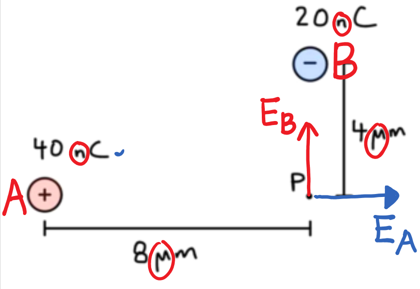
Printout

$\mu = \times 10^{-6}$ $n = \times 10^{-9}$

May 10, 2022 11:33 AM

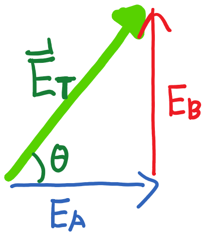
Physics 12: Electrostatic Test Review 1

1a) Determine the electric field at point P
1b) Determine the electric force on an electron placed at point P



$$E_A = \frac{kQ_A}{r_A^2} = \frac{k(40\times10^{-9}C)}{(8\times10^{-6}m)^2} = 5.625\times10^{12}\ N/C\ [R]$$

$$E_B = \frac{kQ_B}{r_B^2} = \frac{k(20\times10^{-9}C)}{(4\times10^{-6}m)^2} = 1.125\times10^{13}\ N/C\ [up]$$

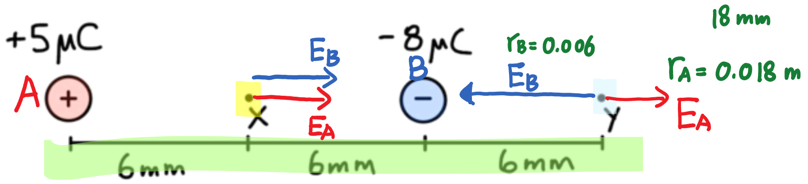


$$\vec{E}_{Tot} = \sqrt{E_A^2 + E_B^2} = 1.258\times10^{13}\ N/C$$

$$\theta = \tan^{-1}\left(\frac{E_B}{E_A}\right) = 63.4°\ [N\ of\ E]$$

b) $F_E = EQ_e = 1.258\times10^{13}\cdot(1.6\times10^{-19}C) = \boxed{2.01\times10^{-6}N \quad 63.4°\ [N\ of\ E]}$

2 a) Determine the electric field at point X
2 b) Determine the electric field at point Y [1.86×10^{9} N/C Left]
2 c) Determine the force on an electron placed at point X [5.2×10^{-10} N] Left.
2 d) Determine the acceleration of a proton placed at point Y



a) $E_A = \frac{kQ_A}{r^2} = \frac{k(5\times10^{-6})}{(0.006)^2} = 1.25\times10^{9}\ N/C\ [R]$

$E_B = \frac{kQ_B}{r^2} = \frac{k(8\times10^{-6})}{(0.006)^2} = 2\times10^{9}\ N/C\ [R]$

$E_{Tot} = E_A + E_B = 3.25\times10^{9}\ N/C\ [R]$

d)

b) $1.86\times10^{9}\ N/C\ [L]$

$F_E = EQ_p = (1.86\times10^{9}\ N/C)(1.6\times10^{-19}C) = 2.976\times10^{-10}\ N$

$F_{net} = m_p a \qquad 2.976\times10^{-10}N = (1.67\times10^{-27}kg)\cdot a \qquad a = 1.78\times10^{17}\ m/s^2\ [L]$

⊕ p $Q_p = 1.6\times10^{-19}\ C$

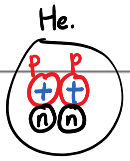
$m_p = 1.67\times10^{-27}\ kg$

e^- $Q_e = -1.6\times10^{-19}C$

$m_e = 9.11\times10^{-31}\ kg$

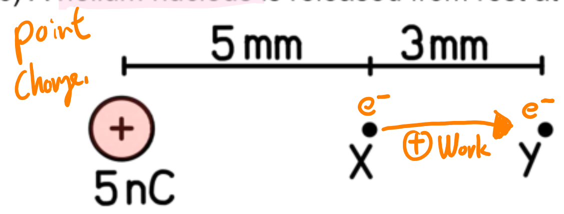
Voltage.

3. For each of the following diagrams, determine
a) The electric potential difference between points X and Y.
b) The work required to bring an electron from X to Y.
c) A helium nucleus is released from rest at X. What is its speed at Y?



$Q = 2p = 2(1.6\times10^{-1})$

$m_{He} = 2m_p + 2m_n \approx 4m_p$



a) $V_x = \frac{kQ}{r} = \frac{k(5\times10^{-9})}{0.005\,m} = 9000V$

$V_y = \frac{k(5\times10^{-9})}{0.008\,m} = 5625V$

$\Delta V = 9000V - 5625V = \boxed{3375V}$

b) $W = \Delta E_p = \Delta V \cdot Q_e = 3375(1.6\times10^{-19})$

$W = \boxed{5.4\times10^{-16}J}$

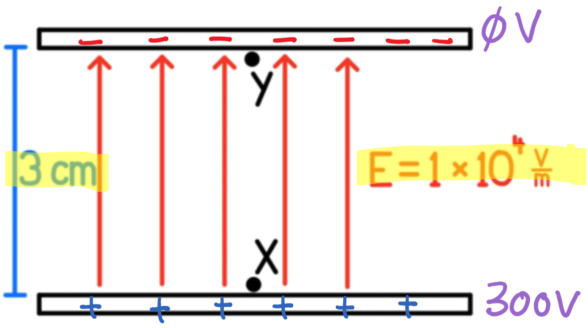
c) $\Delta E_p \rightarrow E_k \rightarrow vel.$

$\Delta E_p = \Delta V Q_{He} = \underbrace{3375V(2\times1.6\times10^{-19})}_{1.08\times10^{-15}J}$

$E_k = \frac{1}{2}m_{He}v^2$

$1.08\times10^{-15}J = \frac{1}{2}[4\times1.67\times10^{-27}kg]\cdot v^2$

$V = 568641 = \boxed{5.69\times10^5\,m/s}$



a) $\vec{E} = \frac{\Delta V}{d}$ $\quad 10000 = \frac{\Delta V}{0.03m}$ $\quad \boxed{\Delta V = 300V}$

b) $W = \Delta E_p = \Delta V Q_e = (300V)(1.6\times10^{-19}C)$

$W = \boxed{4.8\times10^{-17}J}$

c)

$V = \boxed{1.7\times10^5\,m/s}$

$\xrightarrow{\div Q}$ $F = EQ$

Point Charge

[N]	$\vec{F}_E = \frac{k\lvert Q_1Q_2\rvert}{r^2}$	$\vec{E} = \frac{k\lvert Q\rvert}{r^2}$	[N/C]
			$\downarrow \times r$
[J]	$E_p = \frac{kQ_1Q_2}{r}$	$V = \frac{kQ}{r}$	[V]

parallel plates

$\vec{F}_E = \frac{\Delta V\lvert Q\rvert}{d}$	$\vec{E} = \frac{\Delta V}{d}$	
		$\downarrow \times d$
$E_{p\,max} = \Delta V Q$	ΔV	