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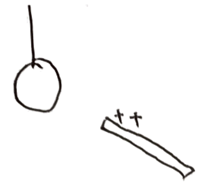
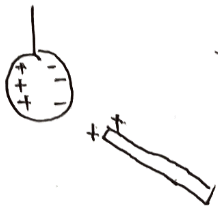
Q21.5

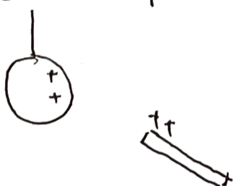


first attached:



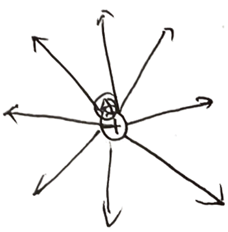
the opposite Charges attract.

after touch they both positively charged

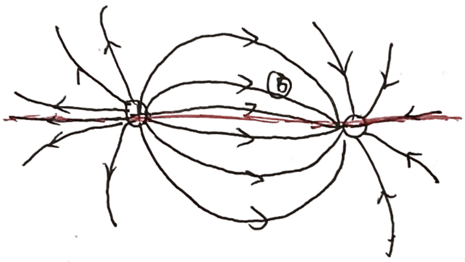


The same charges repel each other.

Q21.9



for Ⓐ directly place on the charge. Yes.
since the direction of the ~~accelera~~ velocity and Coloumb force is at the same direction.
it will follow the Trajectory



for B. No.
only the charge put on the red line Colomb force have the same direction as velocity
otherwise, the force and the velocity is not at the same direction. ~~Thats~~ So the particle will off track.

Q21.11

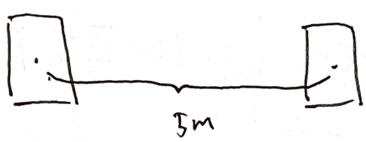
assume that for a text book. it's 1000g.
the mass for proton & neuron is almost the same and assume the mass for electron is 0.
we can assume that there's 500g. protons.

$\Rightarrow$ which means there exits $\frac{500g}{1.67\times10^{-27}kg} = 2.99\times10^{26}$ protons.

since less then 0.001% charge $\Rightarrow$. $2.99\times10^{26}\times0.001\%\times1.6\times10^{-19} = 479\,C$

$\approx 500\,C$.

(positively).



5m

$F = k\frac{Q_1 Q_2}{R^2} = 9\times10^9 \times \frac{500C\times500C}{5m^2} = 4.5\times10^{14}N.$

Since they both positively charged, they attract each other.

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21.28 (a) By using newtons second law & coloumb's law.

$\uparrow Eq \Rightarrow F = mg = Eq$ $\Rightarrow |q| = \frac{mg}{E} = \frac{56\,kg \times 9.8\,m/s^2}{150\,N/C} = 3.66\,C$

$\downarrow mg$ $\Rightarrow$ People is negatively charged $\Rightarrow$ $q = -3.66\,C$.

(b).

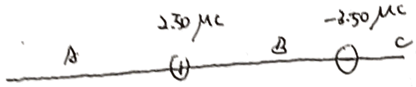
100m.

3.66C 3.66C.

$F = k\frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2} = 9\times10^9 \cdot \frac{3.66C \times 3.66C}{(100m)^2} = 1.20\times10^7\,N$

it's so large so it's not feasible means

21.60



Since +q is stationary $\Rightarrow F_1 = F_2$.

(A) F_1 F_2 $|x_0|$

$\frac{k q_1 \cdot q}{|x_0|^2} = \frac{k q_2 \cdot q}{(0.6+|x_0|)^2} \Rightarrow |x_0| = 3.275\,m$.

$\Rightarrow$ it's location on x axis is $-3.275\,m$.

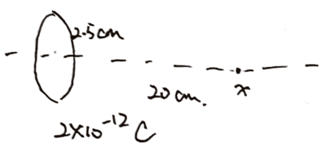
(B) impossible

(C) F_2 F_1 According to (A) $F_1 = F_2$

$\frac{k q_1 \cdot q}{(|x_0| + 0.6)^2} = \frac{k q_2 \cdot q}{|x_0|^2} \Rightarrow$ no solutions

In brief: it's location on x-axis is $-3.275\,m$

21.83. (a)



$dQ = \lambda ds$ $\Rightarrow \lambda = \frac{Q}{2\pi a}$

$dE = \frac{1}{4\pi\varepsilon_0}\frac{dQ}{(x^2+a^2)}$ also $\because \vec{E} = E_x \cdot \hat{i}$

$\Rightarrow dE_x = dE\cos(\alpha) = dE \cdot \frac{x}{\sqrt{x^2+a^2}} = \frac{1}{4\pi\varepsilon_0}\frac{\lambda \cdot ds \cdot x}{(x^2+a^2)^{\frac{3}{2}}}$

$= \frac{1}{4\pi\varepsilon_0}\cdot\frac{dQ \cdot x}{(x^2+a^2)^{\frac{3}{2}}} \Rightarrow \vec{E} = \frac{1}{4\pi\varepsilon_0}\cdot\frac{Qx}{(x^2+a^2)^{\frac{3}{2}}}$

$\Rightarrow \vec{E} = \frac{1}{4\pi\varepsilon_0}\cdot\frac{Q \cdot x}{(x^2+a^2)^{\frac{3}{2}}} = 9\times10^9 \times \frac{2.0\times10^{-12}C \times 0.2m}{((0.2m)^2 + (0.025m)^2)^{\frac{3}{2}}} = 0.44\,N/C$ +x direction

(b) $E = \frac{\sigma}{2\varepsilon_0}\left[1 - \frac{1}{\sqrt{\frac{R^2}{x^2}+1}}\right]$ $\sigma = \frac{Q}{A} \Rightarrow E = \frac{Q}{2\varepsilon_0 A}\left[1 - \frac{1}{\sqrt{\frac{R^2}{x^2}+1}}\right]$ $A = \pi R^2 \Rightarrow E = \frac{Q}{2\varepsilon_0 \pi R^2}\cdot\left[1 - \frac{1}{\sqrt{\frac{R^2}{x^2}+1}}\right]$

$\Rightarrow E = \frac{Q}{2\varepsilon_0 \pi(\frac{R^2}{x^2})\cdot x^2}\left[1 - (1+\frac{R^2}{x^2})^{-\frac{1}{2}}\right]$ for $x \gg R$ $R \ll x$ $\frac{R^2}{x^2} \ll 1 \Rightarrow E = \frac{Q}{4\pi\varepsilon_0 x^2}$

(c) $E_0 = \frac{F}{q} = (\frac{k q q_0}{r^2})/q_0 = \frac{9\times10^9 \times 2.0\times10^{-12}C}{(20\,cm)^2} = 0.45\,N/C$ $E_0 > E$

$\Rightarrow$ smaller. because there is no more perpendicular magnet field.

(d)

for 20 cm. $\% \Delta E = \frac{E_c - E_q}{E_c} = \frac{0.45 N/C - 0.44 N/C}{0.44 N/C} = 1.4\%$

According to (a) & (c)

$E_d = \frac{1}{4\pi\varepsilon_0} \cdot \frac{Q \cdot x}{(x^2+a^2)^{\frac{3}{2}}} = \frac{1}{4\pi\varepsilon_0} \cdot \frac{2.0\times10^{-12} C \times 0.1m}{((0.1m)^2+(0.08m)^2)^{\frac{3}{2}}} = 1.72 N/C.$

$E_p = \frac{kq}{r^2} = \frac{9\times10^9 \times 2\times10^{-12}}{(0.1m)^2} = 1.8 N/C.$

$\Delta E = \frac{E_p - E_d}{E_p} = \frac{1.80N - 1.72N}{1.72N} = 4.65\%$

Essay Question

H_2O Molecule change to a linear one.

⇒ So the electrostatic force in this molecule will disappear.

⇒ The intermolecular force will decrease

⇒. the boiling point and melting point will be at lower temperature.

- it will be gas at STP.
- The solubility of water will be worse.