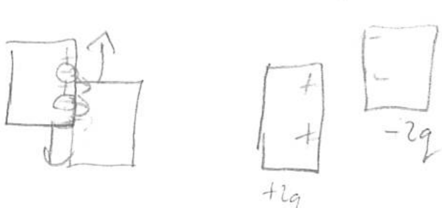
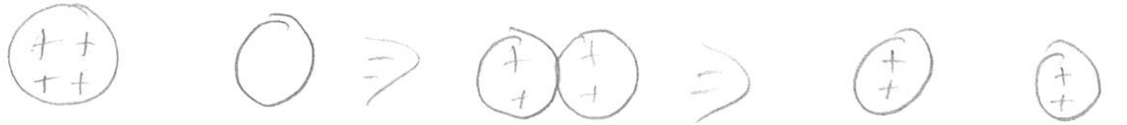
Electrostatics Review

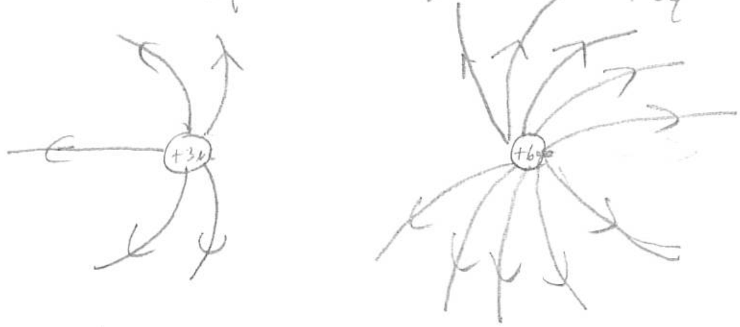
1 a)



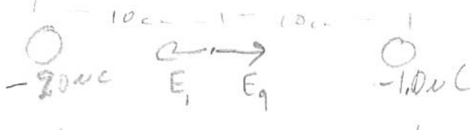
b)



2



3



a) $E_9 = \frac{kq_9}{r_9^2} \Rightarrow E_9 = \frac{(9\times10^9 \frac{Nm^2}{C^2})(9\times10^{-6}C)}{(0.10)^2}$

$E_9 = 8.1\times10^6 \frac{N}{C}$

$E_1 = \frac{kq_1}{r_1^2} \Rightarrow E_1 = \frac{(9\times10^9 \frac{Nm^2}{C^2})(1\times10^{-6}C)}{(0.10)^2}$

$E_1 = 9\times10^5 \frac{N}{C}$

$E_{Net} = E_9 - E_1 = 8.1\times10^6 \frac{N}{C} - 0.9\times10^6 \frac{N}{C} = \boxed{7.2\times10^6 \frac{N}{C}}$

b) $F = qE$

$= (2\times10^{-6}C)(7.2\times10^6 \frac{N}{C})$

$\boxed{F = 14.4N}$

c) The -9μC charge is dominating, so move away from the -9μC and toward -1μC.

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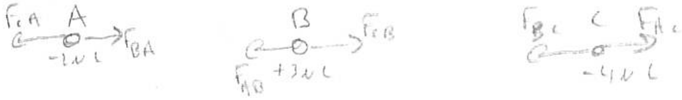

$F = k\frac{q_1 q_2}{r^2}$

a) $F_{AB} = F_{BA} = \frac{(9\times10^9 \frac{Nm^2}{C^2})(2\times10^{-6}C)(3\times10^{-6}C)}{(0.05m)^2} = 21.6N$

$F_{AC} = F_{CA} = \frac{(9\times10^9 \frac{Nm^2}{C^2})(2\times10^{-6}C)(4\times10^{-6}C)}{(0.2m)^2} = 1.8N$

$F_{BC} = F_{CB} = \frac{(9\times10^9 \frac{Nm^2}{C^2})(3\times10^{-6}C)(4\times10^{-6}C)}{(0.15m)^2} = 4.8N$

b) $F_{Net A} = F_{BA} - F_{CA} = 21.6N - 1.8N = \boxed{19.8N} \rightarrow$

$F_{Net B} = F_{CB} - F_{AB} = 4.8N - 21.6 = \boxed{-16.8N} \leftarrow$

$F_{Net C} = F_{AC} - F_{BC} = 1.8N - 4.8N = \boxed{-3N} \leftarrow$

c) $V_T = V_A + V_B + V_C = \frac{(9\times10^9 \frac{Nm^2}{C^2})(-2\times10^{-6}C)}{(0.05m)} + \frac{(9\times10^9 \frac{Nm^2}{C^2})(3\times10^{-6}C)}{(0.10m)} + \frac{(9\times10^9 \frac{Nm^2}{C^2})(-4\times10^{-6}C)}{(0.25m)} = \boxed{-2.34\times10^5 \frac{J}{C}}$

$V = \frac{kq}{r}$

d) $V_T = V_A + V_B + V_C = \frac{(9\times10^9 \frac{Nm^2}{C^2})(-2\times10^{-6}C)}{(0.35m)} + \frac{(9\times10^9 \frac{Nm^2}{C^2})(3\times10^{-6}C)}{(0.30m)} + \frac{(9\times10^9 \frac{Nm^2}{C^2})(-4\times10^{-6}C)}{(0.15m)} = \boxed{-2.0\times10^5 \frac{J}{C}}$

e) $U = \frac{kq_1q_2}{r}$ $U_T = U_{AB} + U_{CB} = \frac{(9\times10^9 \frac{Nm^2}{C^2})(-2\times10^{-6}C)(3\times10^{-6}C)}{(0.05m)} + \frac{(9\times10^9 \frac{Nm^2}{C^2})(-4\times10^{-6}C)(3\times10^{-6}C)}{(0.15m)} = \boxed{-1.8J}$

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Answers

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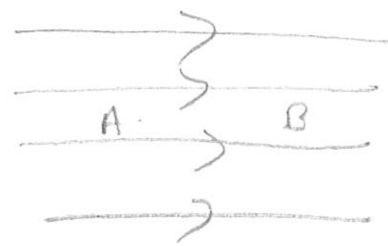
a) A proton would follow the field lines to the right

b) An electron would move counter to the field lines $\Rightarrow$ to the left.



$E = 500\,\frac{N}{C}$

$d_{AB} = 5\,cm$

c) $F = qE \Rightarrow F = (4\times10^{-6}\,C)(500\,\frac{N}{C})$

$\boxed{F = 2.0\times10^{-3}\,N}$

d) $\Delta V = Ed \Rightarrow \Delta V = (500\,\frac{N}{C})(0.05\,m)$

$\boxed{\Delta V = 25\,\frac{J}{C}}$

e) $\Delta U = q\Delta V \Rightarrow \Delta U = (4\times10^{-6}\,C)(25\,\frac{J}{C})$

$\boxed{\Delta U = 1\times10^{-4}\,J}$