Learning Check - Superposition Principle

Show all work, formulas, and given information clearly for maximum credit. Box your final answers.

1) A small cork of mass 5g with a charge of +8µC is placed 0.001m from another 5g cork with a charge of -4 µC. What is the electric force between the corks? (Be sure to note if it is attractive or repulsive.)

$$F_e = k_c \frac{q_1 \cdot q_2}{r^2}$$

$$F_e = (9E9) \frac{(8\times10^{-6})(-4\times10^{-6})}{(0.001)^2} \boxed{= -2.88\times10^5 N}$$

$$\rightarrow \text{Attractive}$$

2) Three point charges lie along the y-axis. If q_1 = +3 µC and is at the origin, q_2 = -5 µC and is located at y = 4m, and q_3 = -6 µC and is at y = 6m.

   a. Calculate the force on q_1. Be sure to note the direction of the force on q_1.

$\uparrow F_{BA}$

$\uparrow F_{CA}$

$$F_{BA} = k_c \frac{q_B q_A}{r^2}$$

$$F_{BA} = (9E9) \frac{(3E-6)(-5E-6)}{4^2} = -8.44\times10^{-3} N$$

$$F_{CA} = k_c \frac{q_c q_A}{r^2}$$

$$F_{CA} = (9E9) \frac{(-6E-6)(3E-6)}{6^2} = -4.5\times10^{-3} N$$

$$(8.44\times10^{-3}) + (4.5\times10^{-3}) = \boxed{12.9\times10^{-3}N}$$

   b. Calculate the electric field strength at a point located at y = 1m on the axis.

$\uparrow E_A$

$\uparrow E_B$

$\uparrow E_C$

$$E_A = \frac{k_c Q}{r^2} = \frac{(9E9)(3E-6)}{1^2} = 27000 \text{N}/\text{c} \uparrow$$

$$E_B = \frac{k_c Q}{r^2} = \frac{(9E9)(-5E-6)}{3^2} = -5000 \text{N}/\text{c} \uparrow$$

$$E_C = \frac{k_c Q}{r^2} = \frac{(9E9)(-6E-6)}{5^2} = -2160 \text{N}/\text{c} \uparrow$$

$$27000 + 5000 + 2160 = \boxed{34160 \text{N}/\text{c} \uparrow}$$

Cm Ⓒ -6µc

4m B Ⓑ -5µc

1m ✗

A
0m Ⓐ 3µc