HW Assignment for Electrostatics
Chapter Questions 19-22, 26-28 and
Chapter Problems 6-12

Chapter Questions 19-22 + 26-28: see Answers to Chapter Questions at the back of packet and ask in class if you have questions.

Chapter Problems 6-12

(6) $-2.5\,\mu C$ $\quad$ $-9.0\,\mu C$

$\leftarrow 25\,cm \rightarrow$

Direction of Force is $\boxed{\text{repulsive}}$

Magnitude of Force is $F_E = \dfrac{K \cdot q_1 \cdot q_2}{r^2}$

$$F_E = \frac{\left(9.0\times10^{9}\,\frac{N\cdot m^2}{C^2}\cdot|-2.5\times10^{-6}\,C|\cdot|-9.0\times10^{-6}\,C|\right)}{(2.5\times10^{-1}\,m)^2}$$

$$F_E = 3.24\,N$$

(7) $F_E = \dfrac{K q_1 q_2}{r^2}$ what is r?

$$r = \sqrt{\frac{K\cdot q_1\cdot q_2}{F_E}} = \sqrt{\frac{9.0\times10^{9}\,\frac{N\cdot m^2}{C^2}\cdot 2.6\times10^{-6}\,C\cdot 5.4\times10^{-6}\,C}{6.5\times10^{-3}\,N}}$$

$$r = 4.4\,m$$

(8) what is r if $F_E = \frac{Kq_1q_2}{r^2}$?

$$r = \sqrt{\frac{K \cdot q_1 \cdot q_2}{F_E}} = \sqrt{\frac{9.0\times10^{9}\,\frac{N\cdot m^2}{C^2} \cdot 7.8\times10^{-6}\,C \cdot 9.2\times10^{-6}\,C}{4.5\times10^{-3}\,N}}$$

$r = 12\,m$

(9) $F = \frac{Kq_1q_2}{r^2}$, so $q_2 = \frac{F \cdot r^2}{Kq_1}$

$$q_2 = \frac{1.8\times10^{-3}\,N \cdot (2.4\,m)^2}{9.0\times10^{9}\,\frac{N\cdot m^2}{C^2} \cdot 4.2\times10^{-6}\,C} = 2.7\times10^{-7}\,C$$

~~= 2.7~~

The charge is positive because it's attracted to negative charge

(10) $F = \frac{Kq_1q_2}{r^2} = F = \frac{Kq^2}{r^2}$, so

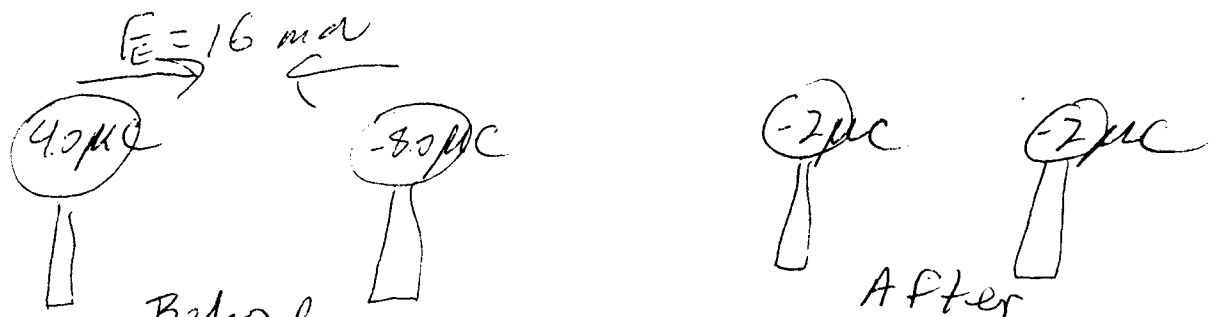
$$q^2 = \frac{F \cdot r^2}{K} = q = \sqrt{\frac{F \cdot r^2}{K}} = \sqrt{\frac{1.8\times10^{-2}\,N \cdot (0.09\,m)^2}{9\times10^{9}\,\frac{N\cdot m^2}{C^2}}}$$

$q_{each} = 1.3\times10^{-7}\,C$

$1e^- = 1.6\times10^{-19}\,C$

so $\frac{1.3\times10^{-7}\,C}{1.6\times10^{-19}\,C} = 7.95\times10^{11}$ electrons

(11)



Before After

$$F_E = \frac{K q_1 q_2}{r^2} = \cancel{9.0\times10^{9}\frac{N\,m^2}{C^2}\cdot 4.0\times10^{-6}C\cdot 8.0\times10^{-6}C}$$

$$r = \sqrt{\frac{K q_1 q_2}{F_E}} = \sqrt{\frac{9.0\times10^{9}\frac{N\,m^2}{C^2}\cdot 4.0\times10^{-6}C\cdot 8.0\times10^{-6}C}{1.6\times10^{-2}\,N}}$$

$$r = \cancel{0.042\,m}\ 4.2\,m$$

After touching, the total charge of the system will be $4-8=-4\mu C$. Each sphere will get half of this charge, so each sphere will now have $-2\mu C$ of charge.

$$F_E = \frac{K q_1 q_2}{r^2} = \frac{9.0\times10^{9}\frac{N\,m^2}{C^2}\cdot 2.0\times10^{-6}C\cdot 2.0\times10^{-6}C}{(\cancel{0.042\,m}\ 4.2\,m)^2} =$$

$2.04\times10^{-3}\,N$ repulsive

(12)

$$\cancel{\frac{9.0\times10^{9}}{6.67\times10^{-11}} = 1.4\times10^{20}}$$

Charge on electron

$$\frac{K q_E q_E}{G m_E m_E} = \frac{9.0\times10^{9}\frac{N\,m^2}{C^2}\cdot 1.6\times10^{-19}C\cdot 1.6\times10^{-19}C}{6.67\times10^{-11}\frac{N\,m^2}{Kg^2}\cdot 9.11\times10^{-31}Kg\cdot 9.11\times10^{-31}Kg} =$$

4.2×10^{42}

mass of electron