SFU Department of Physics

phys102q – Fall 2004 – Assignment 1.
Due Thr. Sep 16, 2004 at 23:59hrs. CAPA ID is **4893**

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1. [1 pt.] Three charges, Q_1, Q_2, and Q_3 are located in a straight line. The position of Q_2 is 0.290m to the right of Q_1. Q_3 is located 0.180m to the right of Q_2. The force on Q_2 due to its interaction with Q_3 is directed to: (Give all correct answers in alphabetical order, for example, if A, B and D were correct then input ABD - no spaces, no commas.)

A) the right if the two charges are negative
B) the left if the two charges are negative
C) the left if the two charges have opposite signs
D) the left if the two charges are positive
E) the right if the two charges have opposite signs

2. [1 pt.] In the last problem, $Q_1 = 2.24\times10^{-6}$C, $Q_2 = -3.22\times10^{-6}$C, and $Q_3 = 3.03\times10^{-6}$C. Calculate the total force on Q_2. Take the positive direction to the right.

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3. [1 pt.] A very small conducting sphere in air carries a charge of 10.85 picocoulombs and is 0.390m from another such sphere carrying a charge Q. If each sphere experiences a mutual electrical repulsion of 2.00μN, find Q.

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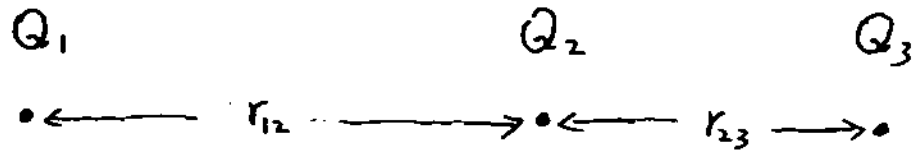
4. [1 pt.] What is the total charge on all the electrons in 21.50cm^3 of water?

Physics 102.

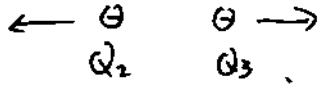
CAPA Set #1. Solutions.

1.

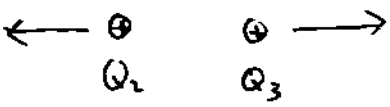


The force on Q_2 due to Q_3 is directed to:

B) the left if the two charges are negative.



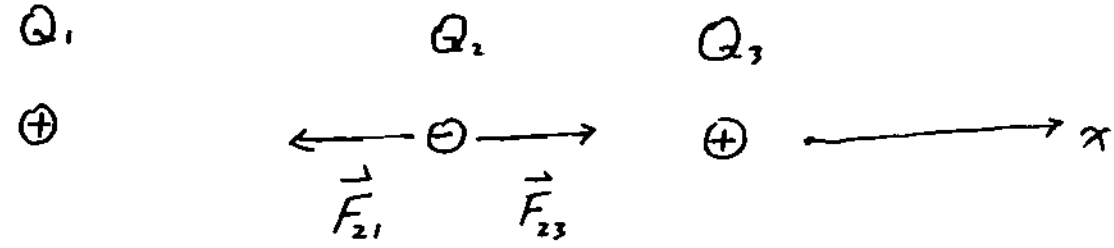
D) the left if the two charges are positive.



E) the right if the two charges have opposite signs.

2.

2.

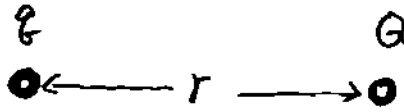


$$\vec{F}_2 = \vec{F}_{21} + \vec{F}_{23} = \left(-|F_{21}| + |F_{23}|\right)\hat{x}$$

$$F_{2x} = -\left|\frac{kQ_1Q_2}{r_{12}^2}\right| + \left|\frac{kQ_2Q_3}{r_{23}^2}\right| = kQ_2\left(\frac{Q_1}{r_{12}^2} - \frac{Q_3}{r_{23}^2}\right)$$

$$= 8.99\times10^{9}\times3.22\times10^{-6}\left(\frac{2.24\times10^{-6}}{0.29^2} - \frac{3.03\times10^{-6}}{0.18^2}\right) = 1.94\,N$$

3.



$q = 10.85\ pC$. $Q > 0$ since the force is repulsive

Coulomb's Law: $F = k\frac{qQ}{r^2}$

$$Q = \frac{r^2F}{kq} = \frac{(0.390)^2\times2.00\times10^{-6}}{8.99\times10^{9}\times10.85\times10^{-12}} = 3.12\times10^{-6}\,C$$

4. Mass of water: $M = \rho\cdot V = 1.00\times21.5\ (g)$.

# of Moles of water: $n = \frac{M}{18} = \frac{21.5}{18} = 1.194$

# of molecules of water $N = n\cdot N_A = 1.194\times6.02\times10^{23} = 7.19\times10^{23}$

# of electrons in a water molecule: (H_2O): 10.

$\therefore$ $Q = -1.60\times10^{-19}\times10\times N = -1.15\times10^{6}\ (C)$