Physics 126 Discussion #1: Chapter 18.1-18.5

1. How many electrons must be removed from an electrically neutral silver dollar to give it a charge of $+3.8 \, \mu C$?

2. Three charges are located along a straight line, as shown below. What is the net electric force on charge $q_2$?

$q_1 = +7.5 \, \mu C \quad q_2 = -4.0 \, \mu C \quad q_3 = +9.0 \, \mu C$

- $x = 0$
- $x = 0.40 \, \text{m}$
- $x = 1.00 \, \text{m}$
3. Three charges are located at the corners of an equilateral triangle, as shown below.
What is the net electric force (magnitude and direction) acting on the top charge, \( q_1 \)?
Take \( d = 0.50 \text{ m} \).

\[ q_1 = +3.5 \mu \text{C} \]
\[ q_2 = +5.0 \mu \text{C} \]
\[ q_3 = -5.0 \mu \text{C} \]
In all of the following problems, use the following constants:
\[ k = 9 \times 10^9 \text{ N m}^2 \text{ C}^{-2}. \]
\[ \epsilon_0 = 8.85 \times 10^{-12} \text{ F m}^{-1}. \]
In all problems, ignore gravity unless it is explicitly mentioned.

Consider the following possibilities in answering questions 1 and 2:

I. Both balls have a positive charge.
II. Both balls have a negative charge.
III. One ball has a positive charge, and the other, a negative charge.
IV. One ball is charged and the other is neutral.

1. In a certain experiment, two balls made of cork are hung from insulating strings. There is a force to the effect of pushing the balls apart, due to charges on the balls. What can be concluded?
   A. I or II.
   B. I or II or III.
   C. III.
   D. III or IV.

2. In a certain experiment, two balls made of cork are hung from insulating strings. There is a force to the effect of pulling the balls together, due to charges on the balls. What can be concluded?
   A. I or II.
   B. I or II or III.
   C. III.
   D. III or IV.
Use the following information in questions 3–5:

Two charges $Q_1 = 2 \times 10^{-16}$ C and $Q_2 = 8 \times 10^{-16}$ C are near each other, and charge $Q_1$ exerts a force $F_{12}$ on $Q_2$.

3. How would $F_{12}$ change if the distance between $Q_1$ and $Q_2$ were increased by a factor of 4?

A. It would decrease by a factor of 16.
B. It would decrease by a factor of 4.
C. It would decrease by a factor of 2.
D. It would increase by a factor of 4.

4. How would $F_{12}$ change if the charges were both doubled, but the distance between them remained the same?

A. $F_{12}$ would decrease by a factor of 4.
B. $F_{12}$ would decrease by a factor of 2.
C. $F_{12}$ would increase by a factor of 2.
D. $F_{12}$ would increase by a factor of 4.

5. What is $F_{21}$, the force that charge $Q_2$ exerts on charge $Q_1$?

A. $F_{12}/4$
B. $F_{12}$
C. $4F_{12}$
D. $16F_{12}$
Use the following information in questions 6 and 7:

A small metal ball having a positive charge is brought near a large solid metal disk on the right side. The ball then touches it and is removed.

6. Which of the following best shows the distribution of the charges before the ball touches the disk?

A. [Diagram A]  B. [Diagram B]
C. [Diagram C]  D. [Diagram D]

7. Which of the following best shows the distribution of the charges after the ball is removed?

A. [Diagram A]  B. [Diagram B]
C. [Diagram C]  D. [Diagram D]

8. A small metal ball having a positive charge is brought near a large solid plastic disk. The ball then touches it on the right side and is removed. Which of the following best shows the distribution of the charges after the ball is removed?

A. [Diagram A]  B. [Diagram B]
C. [Diagram C]  D. [Diagram D]
9. Two charges, a positive charge $Q = 1.1 \times 10^{-10}$ C and a negative charge of the same magnitude, are located $2 \times 10^{-8}$ m apart. A third charge $q = 10^{-17}$ C is located exactly between them. What is the magnitude of the force on charge $q$?

A. $0$ N  
B. $2.5 \times 10^{-12}$ N  
C. $2.5 \times 10^{-6}$ N  
D. $2 \times 10^{-9}$ N

10. One charge ($Q_1 = 3.3 \times 10^{-8}$ C) is located on the $x$-axis at $(10^{-3}$ m, $0$ m), and another charge ($Q_2 = 4.4 \times 10^{-5}$ C) is located on the $y$-axis at $(0$ m, $10^{-3}$ m). A charge $q = 10^{-16}$ C is located at the origin. What is the magnitude of the force on the charge at the origin?

A. $10^{-9}$ N  
B. $2 \times 10^{-5}$ N  
C. $5 \times 10^{-4}$ N  
D. $7 \times 10^{-4}$ N

11. Two positive charges, $Q = 1.1 \times 10^{-10}$ C, are located $10^{-6}$ m apart. A third charge $q = 10^{-17}$ C is located exactly between them. What is the magnitude of the force on charge $q$?

A. $0$ N  
B. $10^{-11}$ N  
C. $10^{-9}$ N  
D. $8 \times 10^{-9}$ N