AP Physics 1 Electrostatics Practice Problems

Multiple Choice

1. A plastic rod is rubbed with a piece of wool. During the process the plastic rod acquires a negative charge and the wool:
   (A) acquires an equal positive charge
   (B) acquires an equal negative charge
   (C) acquires less in magnitude positive charge
   (D) acquires less in magnitude negative charge

2. A positively charged sphere is brought near one end of an uncharged metal bar. The end A and B of the metal bar will be charged:
   (A) positive, negative
   (B) negative, positive
   (C) positive, positive
   (D) negative, negative

3. Sphere A carries a net positive charge, and sphere B is neutral. They are placed near each other on an insulated table. Sphere B is briefly touched with a wire that is grounded. Which statement is correct?
   (A) sphere B remains neutral
   (B) sphere B is now positively charged
   (C) sphere B is now negatively charged
   (D) sphere B is now positive and sphere A is negative

4. An originally neutral electroscope is briefly touched with a negatively charged plastic rod. Which statement is correct?
   (A) electroscope remains neutral
   (B) electroscope becomes negatively charged
   (C) electroscope becomes positively charged.
   (D) electroscope becomes negatively charged and rod becomes positively charged
5. An electric charge Q is placed at the origin. A charge q is placed at point B and the force on charge q due to charge Q is F. What is the force on charge Q if charge q is moved to point A?

(A) 4F   (B) 2F   (C) F/4   (D) F/2

6. A student in a physics lab wants to determine the type of an electric charge on initially charged electroscope. He brings two charged rods without touching the electroscope. The positively charged rod causes the leaves to move further apart and the negatively rod causes leaves to move closer to each other. What type of the electric charge was initially on the electroscope?

(A) positive   (B) negative   (C) neutral   (D) couldn’t be determine because the electroscope wasn’t grounded

7. Two charged objects with an equal charge of Q separated by a distance r attract each other with a certain force. If the charges on both objects are doubled and the separation is halved, the force between them is:

(A) 4 times greater   (B) 2 times greater   (C) 4 times less greater   (D) 16 times greater

8. Two identical conducting spheres are charged to +Q and -3Q and separated by a distance r. The attractive force between the spheres is F. The two spheres are brought in a brief contact and then moved to the original positions. If the new electrostatic force between the spheres is F', which of the following is true?

(A) F' = F   (B) F' = 3F   (C) F' = 1/3 F   (D) F' = 9F

9. A conducting sphere is charged with a negative charge -Q. Which statement about the charge distribution is correct?

(A) Charge is concentrated at the center of the sphere   (B) Charge is concentrated at the bottom part of the sphere   (C) Charge is evenly distributed throughout the volume of the sphere   (D) Charge is evenly distributed on the surface of the sphere

10. Two isolated charges, +2q and -5q, are 2 centimeters apart. If F is the magnitude of the force acting on charge -5Q, what are the magnitude and direction of the force acting on charge +2q?
11. Two electrons are separated by a distance r. Which of the following statements is correct?

(A) There is an attractive electrostatic force between the electrons
(B) There is a repulsive electrostatic force between the electrons
(C) The gravitational force between the electrons much greater than electrostatic force
(D) The electrostatic force is much greater that gravitational force

12. A neutral conducting sphere A is placed on an insulating table. Which of the following will cause the sphere to gain positive charge?

(A) Touch the sphere with a negatively charged rod
(B) Touch the sphere with a positively charged rod
(C) Bring a negatively charged rod near the sphere and briefly touch the sphere with a grounding wire
(D) Bring a positively charged rod near the sphere and briefly touch the sphere with a grounding wire

Multi-correct Section: For each question or incomplete statement, two of the answers are correct. For each question you must select both answers.

Chapter Problems

Coulomb's Law

Classwork (Use \(k = 9 \times 10^9 \text{ Nm}^2/\text{C}^2\))

1. Two positive charges of 1 mC and 10 mC are separated by a distance of 10 m. Find the direction and the magnitude of electrostatic force between the charges. Describe the direction in terms of "the charges attract each other," or "the charges repel each other."

2. A particle with a charge of +7.4 μC is separated from another charged particle with a charge of −3.6 μC by a distance of 1.4 m. Find the direction and the magnitude of electrostatic force between the particles.

3. A +1.4 nC charge exerts a repulsive force of 20.0 mN on a second charge which is located a distance of 2.2 m away from it. What is the magnitude and sign of the second charge?

4. Two spherical objects, whose centers are 8.0 cm apart, have equal negative charges and repel each other with a force of 9.0 mN. What is the charge on each of them? How many extra electrons are on each of them?

5. Two conducting spheres have net charges of +9.00 μC and −7.00 μC and attract each other with a force of 4.00 mN. The spheres are brought in contact and then moved apart to the initial distance. What is the new
force between the spheres? Is this force attractive or repulsive?

6. Two negative charges of 2.5 μC and 9.0 μC are separated by a distance of 25 cm. Find the direction (in terms of repulsive or attractive) and the magnitude of the electrostatic force between the charges.

7. Two charges of +2.6 μC and −5.4 μC experience an attractive force of 6.5 mN. What is the separation between the charges?

8. What is the distance between two charges, +7.8 μC and +9.2 μC, if they exert a force of 4.5 mN on each other?

9. A −4.2 μC charge exerts an attractive force of 1.8 mN on a second charge which is a distance of 2.4 m away. What is the magnitude and sign of the second charge?

10. Two equal negative point charges repel each other with a force of 18.0 mN. What is the charge on each object if the distance between them is 9.00 cm? How many extra electrons are on each object?

11. Two charged conducting spheres have net charges of +4.0 μC and −8.0 μC and attract each other with a force of 16 mN. The spheres are brought into contact and then moved apart to the initial distance. What is the new force between the spheres? Is this force attractive or repulsive?

12. What is the ratio of the electrostatic force to the gravitational force between two electrons?
Answers for Multiple Choice:
1. A
2. B
3. C
4. B
5. A
6. A
7. D
8. C
9. D
10. C
11. BD
12. BC

Chapter Problems

1. 900 N, repulsive
2. $1.3 \times 10^{-1}$ N, attract
3. 7.7mC, positive
4. $-8.0 \times 10^{-8}$ C, $5.0 \times 10^{11}$ electrons
5. $6.36 \times 10^{-9}$ N, repulsive
6. 3.24 N, repulsive
7. 4.4 m
8. 12 m
9. $2.7 \times 10^{-7}$ C, positive
10. $-1.27 \times 10^{-7}$ C, $7.95 \times 10^{11}$ electrons
11. $2.0 \times 10^{-3}$ N repulsive
12. $k q_e q_e / G m_e m_e = 4.2 \times 10^{42}$