

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1. If two macroscopic objects are electrically attracted to each other, 1. _____
 A) both objects must be negatively charged.
 B) one object must be negatively charged and the other object must be positively charged.
 C) both objects must be positively charged.
 D) none of the above statements are absolutely true.

2. Two identical small charged spheres are a certain distance apart, and each initially experiences an electrostatic force of magnitude F due to the other. With time, charge gradually diminishes on both spheres. When each of the spheres has lost half its initial charge, the magnitude of the electrostatic force will be 2. _____
 A) $1/8 F$ B) $1/16 F$ C) $1/4 F$ D) $1/2 F$

3. Two equal and opposite charges a certain distance apart are called an electric "dipole". A positive test charge $+q$ is placed as shown, equidistant from the two charges. 3. _____



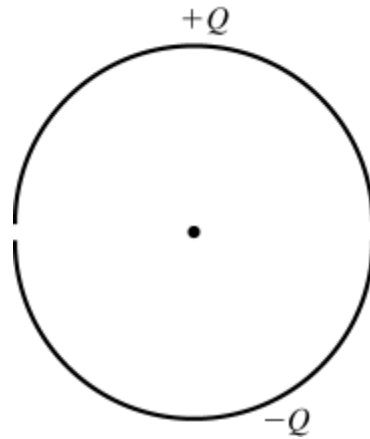
Which diagram below gives the direction of the net force on the test charge?



4. A plastic rod is charged up by rubbing a wool cloth, and brought to an initially neutral metallic sphere. It is allowed to touch the sphere for a few seconds, and then is separated from the sphere by a small distance. After the rod is separated, the rod 4. _____
 A) is attracted to the sphere.
 B) feels no force due to the sphere.
 C) is repelled by the sphere.

5. The equation for the electric field of an object with a net charge Q can be expressed using 5. _____
 $E = kQ/r^2$
 A) if the object is stationary.
 B) if the object is either a point charge or the object is a uniformly charged sphere and r is greater than its radius.
 C) regardless of the shape of the object.
 D) if the object is a sphere, a disk, or a ring.
 E) if and only if the object is a point charge (like an electron or proton).

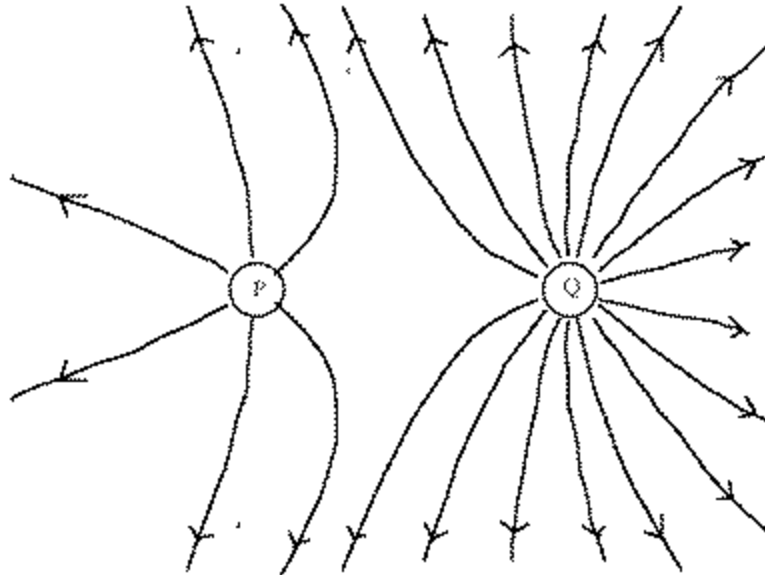
6. A circular conducting ring of radius R is split into two semi-circles. The top half has a positive charge (Q) evenly distributed, and the bottom half has a negative charge ($-Q$), also evenly distributed. The magnitude of the electric field, evaluated in the center of the ring, is _____



- A) zero
B) less than $2kQ/R^2$ but greater than zero.
C) $2kQ/R^2$
7. A hydrogen nucleus, which has a charge e , is situated to the left of a carbon nucleus, which has a charge $6e$. Which statement is true? _____
- A) The electrical force experienced by the hydrogen nucleus is to the right, and the magnitude is equal to the force exerted on the carbon nucleus.
B) The electrical force experienced by the hydrogen nucleus is to the left, and the magnitude is less than the force exerted on the carbon nucleus.
C) The electrical force experienced by the hydrogen nucleus is to the left, and the magnitude is greater than the force exerted on the carbon nucleus.
D) The electrical force experienced by the hydrogen nucleus is to the left, and the magnitude is equal to the force exerted on the carbon nucleus.

8. The diagram shows electric field lines arising from two small charged particles P and Q.

8. _____



Consider the following two statements:

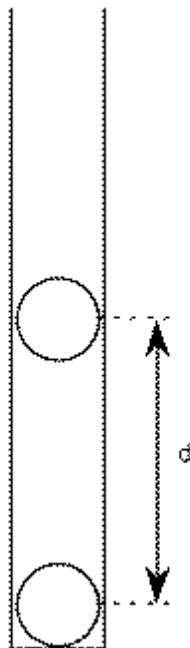
- i. The charge on P is smaller than the charge on Q.
- ii. The electrostatic force on P is smaller than that on Q.

Which of the above statements are true?

- A) Only i. B) Only ii. C) Neither i nor ii. D) Both i and ii.

9. One charged plastic ball is vertically above another in a test tube as shown. The balls are in equilibrium a distance d apart.

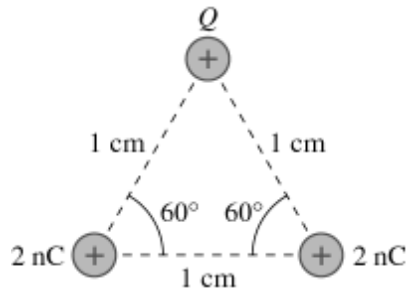
9. _____



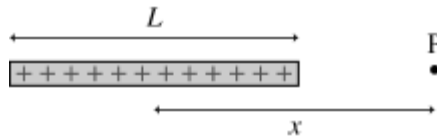
If the charge on each ball is doubled, the distance between the balls in the test tube would become

- A) $\sqrt{2}d$. B) $8d$. C) $2d$. D) $4d$.

10. In the figure $Q = 8.9 \text{ nC}$ and all other quantities are exact. What is the magnitude of the force on the charge Q ? 10. _____

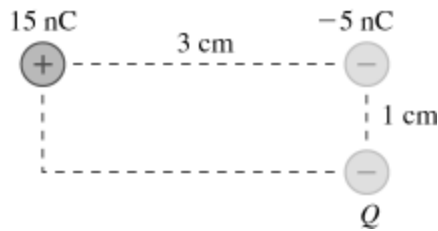


- A) $2.8 \times 10^{-3} \text{ N}$ B) $1.9 \times 10^{-3} \text{ N}$ C) $1.4 \times 10^{-3} \text{ N}$ D) $1.6 \times 10^{-3} \text{ N}$
11. Two like charges of the same magnitude are 3.0 mm apart. If the force of repulsion they exert upon each other is 3.0 N , what is the magnitude of each charge? (The constant of proportionality for the Coulombic force is $9.0 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$.) 11. _____
- A) $3.0 \times 10^3 \text{ C}$ B) $5.5 \times 10^{-2} \text{ C}$ C) $5.5 \times 10^{-8} \text{ C}$ D) $5.5 \times 10^{-5} \text{ C}$
12. Two electrons are passing 27.0 mm apart. What is the electric repulsive force that they exert on each other? (The value of k is $9.0 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$.) 12. _____
- A) 1.2 N B) $3.2 \times 10^{-27} \text{ N}$ C) $3.2 \times 10^{-25} \text{ N}$ D) $1.2 \times 10^{10} \text{ N}$
13. A small piece of aluminum (atomic number 13) contains 10^{15} atoms. (The atomic number is the number of protons; it determines the (positive) electric charge of the nucleus and, thus, the number of electrons in a neutral atom.) If the piece of aluminum has a net positive charge of $8.0 \mu\text{C}$, what fraction of the electrons that the aluminum had when it was neutral would have had to be lost? 13. _____
- A) $\frac{1}{20}$ B) 5.0×10^{-20} C) $\frac{1}{260}$ D) 3.8×10^{-21}
14. What force does a $2.0 \hat{j} \text{ N/C}$ electric field exert on a 10.0 C charge? 14. _____
- A) $0.020 \hat{j} \text{ N}$ B) $0.20 \hat{j} \text{ N}$ C) $20 \hat{j} \text{ N}$ D) $200 \hat{j} \text{ N}$
15. A circular parallel-plate capacitor is formed of two closely spaced disks. The electric field strength in the space between the plates is $1.0 \times 10^5 \text{ N/C}$ as a result of transferring 9.5×10^9 electrons from one disk to the other. What is the diameter of the disks? 15. _____
- A) 2.3 cm B) 7.0 cm C) 4.7 cm D) 9.4 cm
16. The figure shows a thin rod of length $L = 5.0 \text{ cm}$ with total charge $Q = 9.5 \text{ nC}$. What is the magnitude of the electric field E at $x = 3.0 \text{ cm}$? 16. _____

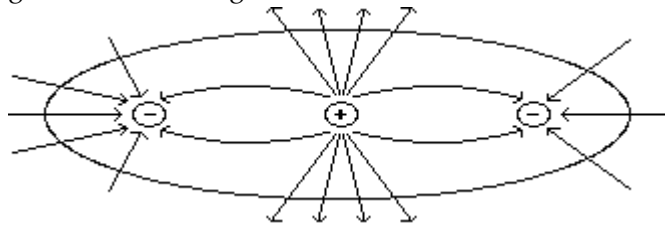


- A) $2.0 \times 10^5 \text{ N/C}$ B) $3.1 \times 10^5 \text{ N/C}$ C) $4.2 \times 10^5 \text{ N/C}$ D) $9.5 \times 10^4 \text{ N/C}$

17. The charge in the bottom right corner of the figure is $Q = -10 \text{ nC}$. What is the magnitude of the force on Q ? 17. _____



- A) $3.2 \times 10^{-3} \text{ N}$ B) $5.9 \times 10^{-3} \text{ N}$ C) $4.3 \times 10^{-3} \text{ N}$ D) $7.9 \times 10^{-3} \text{ N}$
18. A proton is located at $x = 3.0 \text{ nm}$, $y = 0.0 \text{ nm}$ and an electron is located at $x = 0.0 \text{ nm}$, $y = 3.0 \text{ nm}$. Find the attractive Coulombic force between them. (The value of k is $9.0 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$.) 18. _____
- A) $5.0 \times 10^8 \text{ N}$ B) $8.4 \times 10^{-15} \text{ N}$ C) $1.3 \times 10^{-11} \text{ N}$ D) $5.0 \times 10^{-18} \text{ N}$
19. What is the net charge shown in this figure? 19. _____



- A) 0 C B) 16 C
C) 8 C D) 16 times the charge of an electron
20. What is the strength of an electric field that a 0.010 C negative charge experiences 0.90 mm from a 0.20 C positive charge? (The value of K is $9.0 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$.) 20. _____
- A) $5.6 \times 10^{16} \text{ N/C}$ B) $1.1 \times 10^{15} \text{ N/C}$ C) $2.2 \times 10^{15} \text{ N/C}$ D) $2.2 \times 10^{16} \text{ N/C}$
21. A $6.0 \mu\text{C}$ positive charge is located at the origin and a $1.0 \mu\text{C}$ positive charge is located at $x = 0.0 \text{ m}$, $y = 1.0 \text{ m}$. Find the point between them where the electric field strength is zero. 21. _____
- A) $x = 0 \text{ m}$, $y = 6.0 \text{ m}$ B) $x = 0 \text{ m}$, $y = 0.86 \text{ m}$
C) $x = 0 \text{ m}$, $y = 0.17 \text{ m}$ D) $x = 0 \text{ m}$, $y = 0.71 \text{ m}$

1. D
2. C
3. B
4. C
5. B
6. B
7. D
8. A
9. C
10. A
11. C
12. C
13. C
14. C
15. C
16. B
17. C
18. C
19. A
20. C
21. D