Skill 35-Coulomb's Law

30. Two electrons are separated by a distance of 3.00×10^{-6} meter. What are the magnitude and direction of the electrostatic forces each exerts on the other?

(A) 2.56×10^{-17} N away from each other
B) 2.56×10^{-17} N toward each other
C) 7.67×10^{-23} N away from each other
D) 7.67×10^{-23} N toward each other

$F_e = \frac{k q_1 q_2}{r^2} = \frac{8.99\times10^{9}\,N m^2/C^2 (1.6\times10^{-19}C)(1.6\times10^{-19}C)}{(3\times10^{-6}m)^2}$

31. What is the magnitude of the electrostatic force between two electrons separated by a distance of 1.00×10^{-8} meter?

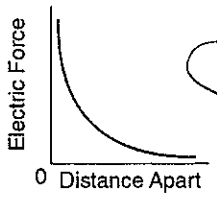
A) 2.56×10^{-22} N B) 2.30×10^{-20} N
(C) 2.30×10^{-12} N D) 1.44×10^{-1} N

$F_e = \frac{k q_1 q_2}{r^2} = \frac{(8.99\times10^{9}\,N m^2/C^2)(1.6\times10^{-19}C)(1.6\times10^{-19}C)}{(1\times10^{-8}m)^2}$

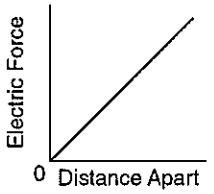
32. An electrostatic force of magnitude F exists between two metal spheres having identical charge q. The distance between their centers is r. Which combination of changes would produce *no* change in the electrostatic force between the spheres?

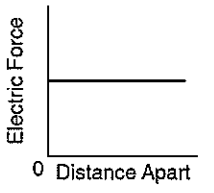
A) doubling q on one sphere while doubling r
(B) doubling q on both spheres while doubling r $\times 4 \div 4 = \times 1$
C) doubling q on one sphere while halving r
D) doubling q on both spheres while halving r

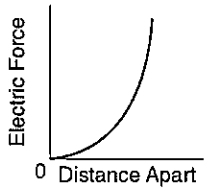
33. Which graph best represents the relationship between the magnitude of the electric force between two identical spheres possesing +1.0 coulomb of charge and −1.0 coulombs of charge respectivly, as well as the distance between them?

A)


$F_e = \frac{k q_1 q_2}{r^2}$

B)


C)


D)


34. A point charge of $+3.0 \times 10^{-7}$ coulomb is placed 2.0×10^{-2} meter from a second point charge of $+4.0 \times 10^{-7}$ coulomb. The magnitude of the electrostatic force between the charges is

(A) 2.7 N B) 5.4×10^{-2} N
C) 3.0×10^{-10} N D) 6.0×10^{-12} N

$F_e = \frac{k q_1 q_2}{r^2}$

$= \frac{8.99\times10^{9}\,N m^2/C^2 (3\times10^{-7}C)(4\times10^{-7}C)}{(2\times10^{-2}m)^2}$

$= 2.7\,N$

Skill 35-Coulomb's Law

35. An electric force F exists between two charged spheres. If the quantity of charge on each sphere is doubled, the electric-force between the two spheres will be equal to

A) $\frac{F}{2}$ B) 2F C) 3F D) 4F

×2 ×2 = 4F

36. Two charges that are 2 meters apart repel each other with a force of 2×10^{-5} Newton. If the distance between the charges is decreased to 1 meter, the force of repulsion will be

A) 1×10^{-5} N B) 5×10^{-6} N
C) 8×10^{-5} N D) 4×10^{-5} N

r ÷2 means F×4

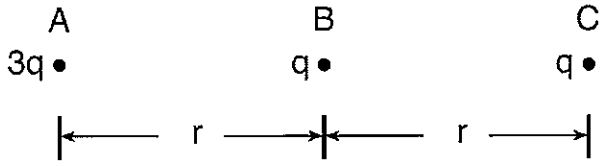
F	r
2×10^{-5} N	2m
8×10^{-5} N	1m ÷2

37. Two point charges attract each other with a force of 8.0×10^{-5} Newton. If the distance between the charges is doubled, the force will become

A) 16×10^{-5} N B) 2.0×10^{-5} N
C) 64×10^{-5} N D) 4.0×10^{-5} N

F	r
8×10^{-5} N	×2
÷4 2×10^{-5} N	

38. The diagram below shows the arrangement of three small spheres, A, B, and C, having charges of $3q$, q, and q, respectively. Spheres A and C are located distance r from sphere B.



Compared to the magnitude of the electrostatic force exerted by sphere B on sphere C, the magnitude of the electrostatic force exerted by sphere A on sphere C is

A) the same B) twice as great
C) $\frac{3}{4}$ as great D) $\frac{3}{2}$ as great

	q	r	F
AC	3q	2r	3/4 F
BC	q	r	F

39. If the charge on each of two small charged metal spheres is doubled and the distance between the spheres remains fixed, the magnitude of the electric force between the spheres will be

A) the same
B) two times as great
C) one-half as great
D) four times as great

40. If the charge on one of two small charged spheres is doubled while the distance between them remains the same, the electrostatic force between the point sources will be

A) halved B) doubled
C) tripled D) unchanged

41. If the magnitude of the charge on each of two positively charged objects is halved, the electrostatic force between the objects will

A) decrease to one-half
(B) decrease to one-quarter
C) decrease to one-sixteenth
D) remain the same

$\frac{q}{2} \cdot \frac{q}{2} = \frac{q}{4}$