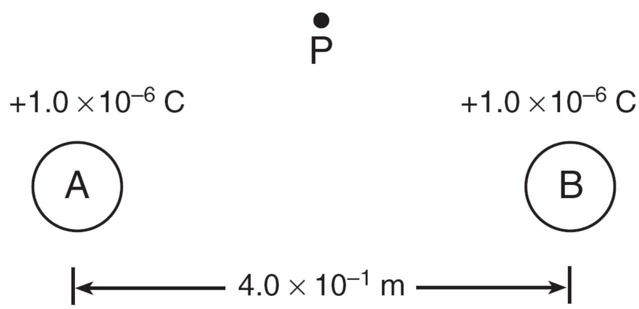
Name: **Complex Equations** **Period:**

1. 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

2. Base your answer to the following question on the information and diagram below.

   Two small metallic spheres, *A* and *B*, are separated by a distance of 4.0×10^{-1} meter, as shown. The charge on each sphere is $+1.0 \times 10^{-6}$ coulomb. Point *P* is located near the spheres.



   What is the magnitude of the electrostatic force between the two charged spheres?

   A) 2.2×10^{-2} N B) 5.6×10^{-2} N
   C) 2.2×10^{4} N D) 5.6×10^{4} N

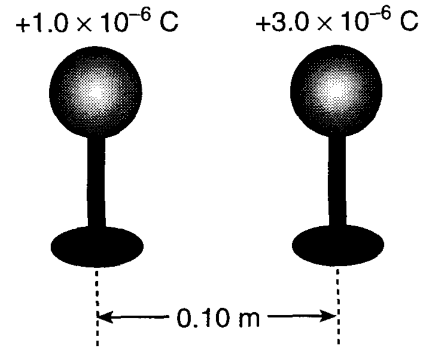
3. What is the approximate electrostatic force between two protons separated by a distance of 1.0×10^{-6} meter?

   A) 2.3×10^{-16} N and repulsive
   B) 2.3×10^{-16} N and attractive
   C) 9.0×10^{21} N and repulsive
   D) 9.0×10^{21} N and attractive

4. 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

5. The diagram below shows two metal spheres charged to $+1.0 \times 10^{-6}$ coulomb and $+3.0 \times 10^{-6}$ coulomb, respectively, on insulating stands separated by a distance of 0.10 meter.



   The spheres are touched together and then returned to their original positions. As a result, the magnitude of the electrostatic force between the spheres changes from 2.7 N to

   A) 1.4 N B) 1.8 N C) 3.6 N D) 14 N

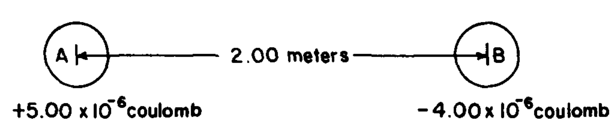
6. Two charges that are 2 meters apart repel each other with a force of 2×10^{-5} Newton. If the distance between the charges is decreased to 1 meter, the force of repulsion will be

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

7. What is the magnitude of the electrostatic force between a charge of $+3.0 \times 10^{-5}$ coulomb and a charge of $+6.0 \times 10^{-6}$ coulomb separated by 0.30 meter?

   A) 1.8×10^{-3} N B) 5.4×10^{-2} N
   C) 5.4×10^{0} N D) 1.8×10^{1} N

8. Base your answer to the following question on the diagram below which represents two small, charged conducting spheres, identical in size, located 2.00 meters apart.

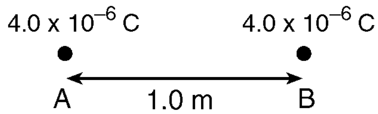


   The force between these spheres is

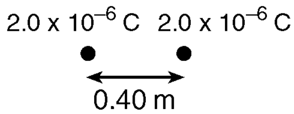
   A) 1.80×10^{-2} N B) 3.60×10^{-2} N
   C) 4.50×10^{-2} N D) 9.00×10^{-2} N

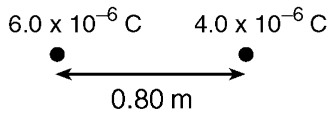
Complex Equations

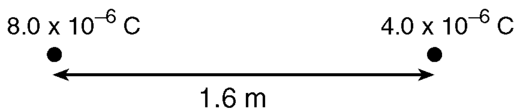
9. The diagram below shows two small metal spheres, *A* and *B*. Each sphere possesses a net charge of 4.0 × 10^{-6} coulomb. The spheres are separated by a distance of 1.0 meter.

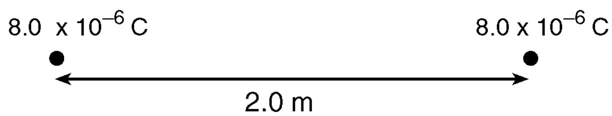


Which combination of charged spheres and separation distance produces an electrostatic force of the same magnitude as the electrostatic force between spheres *A* and *B*?

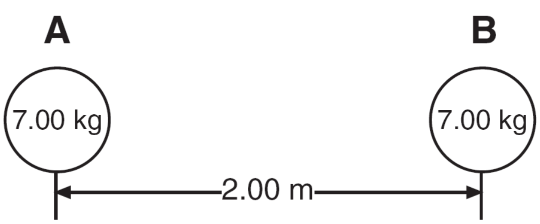
A) 

B) 

C) 

D) 

10. The diagram shows two bowling balls, *A* and *B*, each having a mass of 7.00 kilograms, placed 2.00 meters apart.



What is the magnitude of the gravitational force exerted by ball *A* on ball *B*?

A) 8.17×10^{-9} N B) 1.63×10^{-9} N
C) 8.17×10^{-10} N D) 1.17×10^{-10} N

11. The centers of two 15.0-kilogram spheres are separated by 3.00 meters. The magnitude of the gravitational force between the two spheres is approximately

A) 1.11×10^{-10} N B) 3.34×10^{-10} N
C) 1.67×10^{-9} N D) 5.00×10^{-9} N

12. What is the magnitude of the gravitational force between two 5.0-kilogram masses separated by a distance of 5.0 meters?

A) 5.0×10^{0} N B) 3.3×10^{-10} N
C) 6.7×10^{-11} N D) 1.3×10^{-11} N