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?

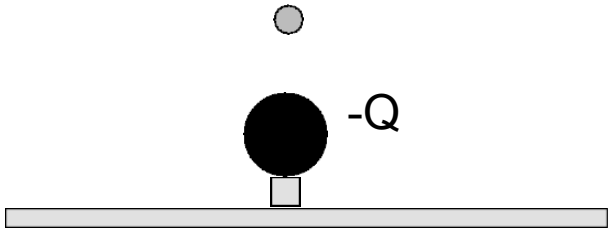
10 Two equal negative point charges repel each other with a force of 18.0 mN. What is the charge on each object if the distance between them is 9.00 cm? How many extra electrons are on each object?

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?

13 **A conducting sphere is carrying a negative charge of –6.0 μC and is placed on an insulated tabletop. A 0.20 g oil drop is floating in the air, 1.5 m above the sphere.**

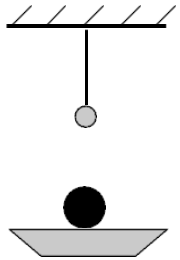
a. Draw a free-body diagram showing all the forces acting on the drop.
b. What is the sign of the net charge on the drop?
c. Determine the magnitude of the electric charge on the drop.
d. If we double the charge on the drop, what will be its initial acceleration?



14 **A 0.140 kg metal ball is suspended at the end of a string and carries a positive charge of +10.0 nC. A charged sphere with a negative charge of -25.0 μC is placed at 5.00 cm below the ball.**

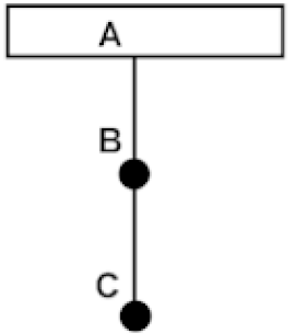
a. Draw a free-body diagram showing all the forces acting on the ball.
b. Find the tension force in the string.
c. If the maximum tension force that the string can withstand is 3.00 N, how much charge must be added to the ball in order to break the string?
d. What will be the tension force in the string if we changed the charge on the sphere from -25.0 μC to +25.0 μC and leave the charge of the suspended ball at +10.0 nC?

Students type their answers here



15 **Two identical balls (B and C) with a mass of 0.500 g are suspended from two strings as show below. The balls carry equal charges, +10.0 nC each and are separated by a distance of 4.00 cm.**

a. Draw a free-body diagram and show all forces applied to ball C.
b. Find the tension force in the string BC.
c. Draw a free-body diagram and show all forces applied on ball B.
d. Find the tension force in string AB.
e. Answer questions a, b, c and d for the situation when the balls have equal but opposite charges (charge on B is positive and the charge on C is negative).



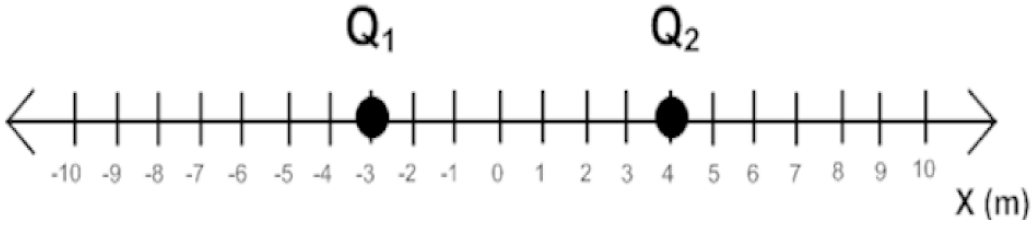
16 A positive charge $Q_1 = 2.6\ \mu C$ is located at a point $X_1 = -3.0$ m and a positive charge $Q_2 = 1.4\ \mu C$ is located at a point $X_2 = +4.0$ m.

a. Draw free body diagrams for the electric force acting on Q_1 and Q_2.

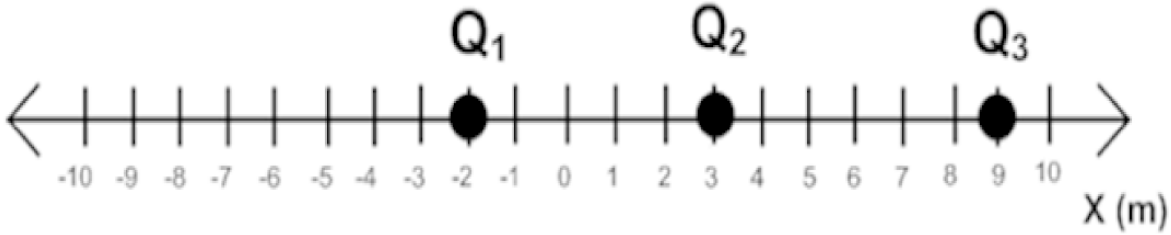
b. Find the magnitude of the electric force between Q_1 and Q_2.

c. Find the magnitude and direction of the electric force acting on Q_1.

d. Find the magnitude and direction of the electric force acting on Q_2.

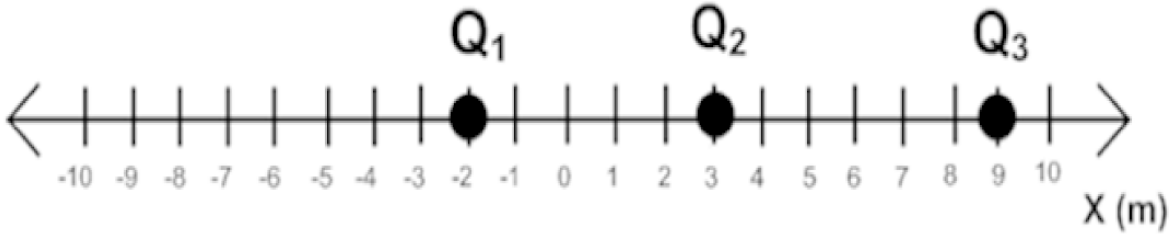


17 **A positive charge Q_1 = 7.4 μC is located at a point X_1 = -2.0 m, a negative charge Q_2 = -9.7 μC is located at a point X_2 = 3.0 m and a positive charge Q_3 = 2.1 μC is located at a point X_3 = 9.0 m.



a. Draw free body diagrams for the electric force acting on Q_1, Q_2 and Q_3.
b. Find the magnitude of the force between Q_1 and Q_2.
c. Find the magnitude of the force between Q_1 and Q_3.
d. Find the magnitude of the force between Q_2 and Q_3.
e. Find the magnitude and direction of the net electric force on charge Q_1.
f. Find the magnitude and direction of the net electric force on charge Q_2.
g. Find the magnitude and direction of the net electric force on charge Q_3.

18 **A negative charge Q_1 = -25.0 μC is located at a point X_1 = -2.0 m, a positive charge Q_2 = 15 μC is located at a point X_2 = 3.0 m and a positive charge Q_3 = 18 μC is located at a point X_3 = 9.0 m.



a. Draw free body diagrams for the electric force acting on Q_1, Q_2 and Q_3.
b. Find the magnitude of the force between Q_1 and Q_2.
c. Find the magnitude of the force between Q_1 and Q_3.
d. Find the magnitude of the force between Q_2 and Q_3.
e. Find the magnitude and direction of the net electric force on charge Q_1.
f. Find the magnitude and direction of the net electric force on charge Q_2.
g. Find the magnitude and direction of the net electric force on charge Q_3.