When you rub a plastic rod with fur, the plastic rod becomes negatively charged and the fur becomes positively charged. As a consequence of rubbing the rod with the fur,

A. the rod and fur both gain mass.
B. the rod and fur both lose mass.
C. the rod gains mass and the fur loses mass.
D. the rod loses mass and the fur gains mass.
E. none of the above
When you rub a plastic rod with fur, the plastic rod becomes negatively charged and the fur becomes positively charged. As a consequence of rubbing the rod with the fur,

- A. the rod and fur both gain mass.
- B. the rod and fur both lose mass.
- C. the rod gains mass and the fur loses mass.
- D. the rod loses mass and the fur gains mass.
- E. none of the above
Q21.2

A positively-charged piece of plastic exerts an attractive force on an electrically neutral piece of paper. This is because

A. electrons are less massive than atomic nuclei.

B. the electric force between charged particles decreases with increasing distance.

C. an atomic nucleus occupies only a small part of the volume of an atom.

D. a typical atom has many electrons but only one nucleus.
A positively-charged piece of plastic exerts an attractive force on an electrically neutral piece of paper. This is because

A. electrons are less massive than atomic nuclei.

B. the electric force between charged particles decreases with increasing distance.

C. an atomic nucleus occupies only a small part of the volume of an atom.

D. a typical atom has many electrons but only one nucleus.
Three point charges lie at the vertices of an equilateral triangle as shown. All three charges have the same magnitude, but Charges #1 and #2 are positive (+q) and Charge #3 is negative (−q).

The net electric force that Charges #2 and #3 exert on Charge #1 is in

A. the +x-direction.  
B. the −x-direction.  
C. the +y-direction.  
D. the −y-direction.  
E. none of the above
Three point charges lie at the vertices of an equilateral triangle as shown. All three charges have the same magnitude, but Charges #1 and #2 are positive (+q) and Charge #3 is negative (−q).

The net electric force that Charges #2 and #3 exert on Charge #1 is in

A. the +x-direction.  
C. the +y-direction.  
E. none of the above
Three point charges lie at the vertices of an equilateral triangle as shown. All three charges have the same magnitude, but Charge #1 is positive (+q) and Charges #2 and #3 are negative (–q).

The net electric force that Charges #2 and #3 exert on Charge #1 is in

A. the +x-direction.  
B. the –x-direction.  
C. the +y-direction.  
D. the –y-direction.  
E. none of the above
Three point charges lie at the vertices of an equilateral triangle as shown. All three charges have the same magnitude, but Charge #1 is positive (+q) and Charges #2 and #3 are negative (−q).

The net electric force that Charges #2 and #3 exert on Charge #1 is in

A. the +x-direction.  B. the −x-direction.
C. the +y-direction.  D. the −y-direction.

E. none of the above
Q21.5

Two point charges and a point $P$ lie at the vertices of an equilateral triangle as shown. Both point charges have the same magnitude $q$ but opposite signs. There is nothing at point $P$.

The net electric field that Charges #1 and #2 produce at point $P$ is in

A. the $+x$-direction.  
B. the $-x$-direction.  
C. the $+y$-direction.  
D. the $-y$-direction.  
E. none of the above.
Two point charges and a point $P$ lie at the vertices of an equilateral triangle as shown. Both point charges have the same magnitude $q$ but opposite signs. There is nothing at point $P$.

The net electric field that Charges #1 and #2 produce at point $P$ is in

A. the $+x$-direction.  
B. the $-x$-direction.

C. the $+y$-direction.  
D. the $-y$-direction.

E. none of the above
Q21.6

Two point charges and a point \( P \) lie at the vertices of an equilateral triangle as shown. Both point charges have the same negative charge \((-q)\). There is nothing at point \( P \).

The net electric field that Charges #1 and #2 produce at point \( P \) is in

A. the +x-direction.  
B. the –x-direction.  
C. the +y-direction.  
D. the –y-direction.  
E. none of the above
A21.6

Two point charges and a point \( P \) lie at the vertices of an equilateral triangle as shown. Both point charges have the same negative charge \((-q)\). There is nothing at point \( P \).

The net electric field that Charges \#1 and \#2 produce at point \( P \) is in

A. the +x-direction.  
B. the –x-direction.  
C. the +y-direction.  
D. the –y-direction.  
E. none of the above
Q21.7

The illustration shows the electric field lines due to three point charges. Which one is a negative charge

A. 1
B. 2
C. 3
D. none of the above
A21.7

The illustration shows the electric field lines due to three point charges. Which one is a negative charge

A. 1

B. 2

✓ C. 3

D. none of the above
The illustration shows the electric field lines due to three point charges. The magnitude of the electric field is strongest:

A. where the field lines are closest together.
B. where the field lines are farthest apart.
C. where adjacent field lines are parallel.
D. none of the above
A21.8

The illustration shows the electric field lines due to three point charges. The magnitude of the electric field is strongest

✓ A. where the field lines are closest together.

B. where the field lines are farthest apart.

C. where adjacent field lines are parallel.

D. none of the above
Q21.9

Positive charge is uniformly distributed around a semicircle. The electric field that this charge produces at the center of curvature $P$ is in

A. the $+x$-direction.
B. the $-x$-direction.
C. the $+y$-direction.
D. the $-y$-direction.
E. none of the above
Positive charge is uniformly distributed around a semicircle. The electric field that this charge produces at the center of curvature \( P \) is in

A. the \(+x\)-direction.
B. the \( -x \)-direction.
C. the \(+y\)-direction.
D. the \(-y\)-direction.
E. none of the above
Q21.10

Three point charges lie at the vertices of an equilateral triangle as shown. Charges #2 and #3 make up an electric dipole.

The net electric torque that Charge #1 exerts on the dipole is

A. clockwise.

B. counterclockwise.

C. zero.

D. not enough information given to decide
Three point charges lie at the vertices of an equilateral triangle as shown. Charges #2 and #3 make up an electric dipole. The net electric torque that Charge #1 exerts on the dipole is

A. clockwise.
B. counterclockwise.
C. zero.
D. not enough information given to decide

✓ A. clockwise.
Q21.11

Three point charges lie at the vertices of an equilateral triangle as shown. Charges #2 and #3 make up an electric dipole.

The net electric force that Charge #1 exerts on the dipole is in

A. the +x-direction.  
B. the –x-direction.  
C. the +y-direction.  
D. the –y-direction.  
E. none of the above
Three point charges lie at the vertices of an equilateral triangle as shown. Charges #2 and #3 make up an electric dipole.

The net electric force that Charge #1 exerts on the dipole is in

A. the +x-direction.  B. the –x-direction.

C. the +y-direction.  D. the –y-direction.

E. none of the above