Giancoli Ch 16 Practice MC

MisConceptual Questions

1. $Q_1 = -0.10\,\mu C$ is located at the origin. $Q_2 = +0.10\,\mu C$ is located on the positive x axis at $x = 1.0\,m$. Which of the following is true of the force on Q_1 due to Q_2?
(*a*) It is attractive and directed in the $+x$ direction.
(*b*) It is attractive and directed in the $-x$ direction.
(*c*) It is repulsive and directed in the $+x$ direction.
(*d*) It is repulsive and directed in the $-x$ direction.

2. Swap the positions of Q_1 and Q_2 of MisConceptual Question 1. Which of the following is true of the force on Q_1 due to Q_2?
(*a*) It does not change.
(*b*) It changes from attractive to repulsive.
(*c*) It changes from repulsive to attractive.
(*d*) It changes from the $+x$ direction to the $-x$ direction.
(*e*) It changes from the $-x$ direction to the $+x$ direction.

3. Fred the lightning bug has a mass m and a charge $+q$. Jane, his lightning-bug wife, has a mass of $\frac{3}{4}m$ and a charge $-2q$. Because they have charges of opposite sign, they are attracted to each other. Which is attracted more to the other, and by how much?

(a) Fred, twice as much.

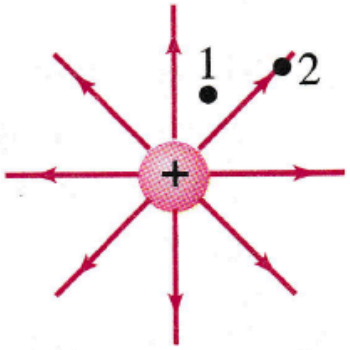
(b) Jane, twice as much.

(c) Fred, four times as much.

(d) Jane, four times as much.

(e) They are attracted to each other by the same amount.

FIGURE 16–50
MisConceptual Question 4.



4. Figure 16–50 shows electric field lines due to a point charge. What can you say about the field at point 1 compared with the field at point 2?

(*a*) The field at point 2 is larger, because point 2 is on a field line.

(*b*) The field at point 1 is larger, because point 1 is not on a field line.

(*c*) The field at point 1 is zero, because point 1 is not on a field line.

(*d*) The field at point 1 is larger, because the field lines are closer together in that region.

5. A negative point charge is in an electric field created by a positive point charge. Which of the following is true?

(*a*) The field points toward the positive charge, and the force on the negative charge is in the same direction as the field.

(*b*) The field points toward the positive charge, and the force on the negative charge is in the opposite direction to the field.

(*c*) The field points away from the positive charge, and the force on the negative charge is in the same direction as the field.

(*d*) The field points away from the positive charge, and the force on the negative charge is in the opposite direction to the field.

6. As an object acquires a positive charge, its mass usually

(*a*) decreases.

(*b*) increases.

(*c*) stays the same.

(*d*) becomes negative.

7. Refer to Fig. 16–32d. If the two charged plates were moved until they are half the distance shown without changing the charge on the plates, the electric field near the center of the plates would

(*a*) remain almost exactly the same.
(*b*) increase by a factor of 2.
(*c*) increase, but not by a factor of 2.
(*d*) decrease by a factor of 2.
(*e*) decrease, but not by a factor of 2.

8. We wish to determine the electric field at a point near a positively charged metal sphere (a good conductor). We do so by bringing a small positive test charge, q_0, to this point and measure the force F_0 on it. F_0/q_0 will be _____ the electric field $\vec{\mathbf{E}}$ as it was at that point before the test charge was present.

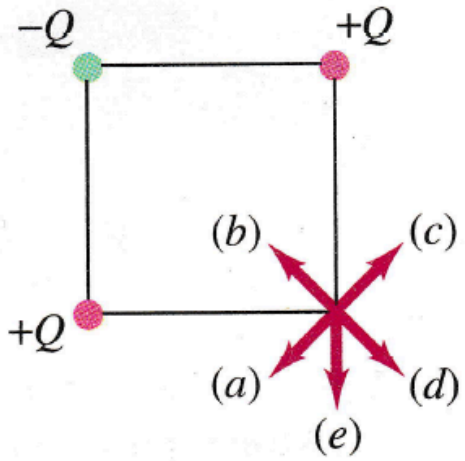
(*a*) greater than
(*b*) less than
(*c*) equal to

9. We are usually not aware of the electric force acting between two everyday objects because
(*a*) the electric force is one of the weakest forces in nature.
(*b*) the electric force is due to microscopic-sized particles such as electrons and protons.
(*c*) the electric force is invisible.
(*d*) most everyday objects have as many plus charges as minus charges.

10. To be safe during a lightning storm, it is best to be
(*a*) in the middle of a grassy meadow.
(*b*) inside a metal car.
(*c*) next to a tall tree in a forest.
(*d*) inside a wooden building.
(*e*) on a metal observation tower.

11. Which are the worst places in MisConceptual Question 10?

FIGURE 16–51
MisConceptual Question 12.



12. Which vector best represents the direction of the electric field at the fourth corner of the square due to the three charges shown in Fig. 16–51?

13. A small metal ball hangs from the ceiling by an insulating thread. The ball is attracted to a positively charged rod held near the ball. The charge of the ball must be
(*a*) positive.
(*b*) negative.
(*c*) neutral.
(*d*) positive or neutral.
(*e*) negative or neutral.

Ch 16: Responses to MisConceptual Questions

1. (a) The two charges have opposite signs, so the force is attractive. Since is located on the positive x axis relative to at the origin, the force on will be in the positive x direction.

2. (d) The signs of the charges are still opposite, so the force remains attractive. However, since is now located at the origin with on the positive x axis, the force on will now be toward the origin, or in the negative x direction.

3. (e) A common misconception is that the object with the greater charge and smaller mass has a greater force of attraction. However, Newton's third law applies here. The force of attraction is the same for both lightning bugs.

4. (d) Students sometimes believe that electric fields only exist on electric field lines. This is incorrect. The field lines represent the direction of the electric field in the region of the lines. The magnitude of the field is proportional to the density of the field lines. At point 1 the field lines are closer together than they are at point two. Therefore, the field at point 1 is larger than the field at point 2.

5. (d) A common misconception students have is recognizing which object is creating the electric field and which object is interacting with the field. In this question the positive point charge is creating the field. The field from a positive charge always points away from the charge. When a negative charge interacts with an electric field, the force on the negative charge is in the opposite direction from the field. The negative charge experiences a force toward the positive charge.

6. (a) An object acquires a positive charge when electrons are removed from the object. Since electrons have mass, as they are removed the mass of the object decreases.

7. (a) Students frequently think of the plates as acting like point charges with the electric field increasing as the plates are brought closer together. However, unlike point charges, the electric field lines from each plate are parallel with uniform density. Bringing the plates closer together does not affect the electric field between them.

8. (b) The value measured will be slightly less than the electric field value at that point before the test charge was introduced. The test charge will repel charges on the surface of the conductor, and these charges will move along the surface to increase their distances from the test charge. Since they will then be at greater distances from the point being tested, they will contribute a smaller amount to the field.

9. (d) Students may equate the lack of the electric force between everyday objects as a sign that the electric force is weaker than other forces in nature. Actually, the electric force between charged particles is much greater than the gravitational force between them. The apparent lack of electric force between everyday objects is because most objects are electrically neutral. That is, most objects have the same number of positive and negative charges in them.

10. (b) In a lightning storm, charged particles in the clouds and ground create large electric fields that ionize the air, creating lightning bolts. People are good conductors of electric charge and when located in the electric field can serve as conduits of the lightning bolt. The inside of a metal car acts like a cavity in a conductor, shielding the occupants from the external electric fields. In each of the other options the person remains in the storm's electric field and therefore may be struck by the lightning. If the car is struck by lightning, then the electricity will pass along the exterior of the car, leaving the people inside unharmed.

11. (a, c, e) Lightning will generally travel from clouds to the tallest conductors in the area. If the person is in the middle of a grassy field, near the tallest tree, or on a metal observation tower, then he or she is likely to be struck by lightning. A person inside a wooden building or inside a car is somewhat shielded from the lightning.

12. (d) The electric field at the fourth corner is the vector sum of the electric fields from the charges at the other three corners. The two positive charges create equal-magnitude electric fields pointing in the positive x direction and in the negative y direction. These add to produce an electric field in the direction of (d) with magnitude times the magnitude of the electric field from one of the charges. The electric field from the negative charge points in the direction of (b). However, since the charge is times farther away than the positive charges, the magnitude of the electric field will be smaller than the field from the positive charges. The resulting field will then be in the direction of (d).

13. (e) A common misconception is that the metal ball must be negatively charged. While a negatively charged ball will be attracted to the positive rod, a neutral conductor will become polarized and also be attracted to the positive rod.