CHAPTER REVIEW

Concept Items

18.3 Electric Field

7. Why can electric fields not cross each other?

a. Many electric-field lines can exist at any given point in space.
b. No electric-field lines can exist at any given point in space.
c. Only a single electric-field line can exist at any given point in space.
d. Two electric-field lines can exist at the same point in space.

8. A constant electric field is $(4.5 \times 10^5\ \text{N/C})\hat{y}$. In which direction is the force on a –20 nC charge placed in this field?

a. The direction of the force is in the $+\hat{x}$ direction.
b. The direction of the force is in the $+\hat{x}$ direction.
c. The direction of the force is in the $-\hat{y}$ direction.
d. The direction of the force is in the $+\hat{y}$ direction.

Critical Thinking Items

18.3 Electric Field

20. An arbitrary electric field passes through a box-shaped volume. There are no charges in the box. If 11 electric-field lines enter the box, how many electric-field lines must exit the box?

a. nine electric field lines
b. 10 electric field lines
c. 11 electric field lines
d. 12 electric field lines

21. In a science-fiction movie, a villain emits a radial electric field to repulse the hero. Knowing that the hero is electrically neutral, is this possible? Explain your reasoning.

a. No, because an electrically neutral body cannot be repelled or attracted.
b. No, because an electrically neutral body can be attracted but not repelled.
c. Yes, because an electrically neutral body can be repelled or attracted.
d. Yes, because an electrically neutral body can be repelled.

Problems

18.1 Electrical Charges, Conservation of Charge, and Transfer of Charge

25. A dust particle acquires a charge of –13 nC. How many excess electrons does it carry?

a. 20.8×10^{-28} electrons
b. $20.8 \times {}^{-19}$ electrons
c. 8.1×10^{10} electrons
d. 8.1×10^{19} electrons

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29. An electric field $(15\ \text{N/C})\hat{z}$ applies a force $(-3 \times 10^{-6}\ \text{N})\hat{z}$ on a particle. What is the charge on the particle?

a. -2.0×10^{-7} C
b. 2.0×10^{-7} C
c. 2.0×10^{-8} C
d. 2.0×10^{-9} C

30. Two uniform electric fields are superimposed. The first electric field is $\vec{E}_1 = (14\ \text{N/C})\hat{x}$. The second electric field is $\vec{E}_2 = (7.0\ \text{N/C})\hat{y}$. With respect to the positive *x* axis, at which angle will a positive test charge accelerate in this combined field?

a. 27°
b. 54°
c. 90°
d. 108°

TEST PREP

Multiple Choice

18.1 Electrical Charges, Conservation of Charge, and Transfer of Charge

36. A neutral hydrogen atom has one proton and one electron. If you remove the electron, what will be the leftover sign of the charge?

a. negative
b. positive
c. zero
d. neutral

37. What is the charge on a proton?

a. $+8.99 \times 10^{-9}$ C
b. -8.99×10^{-9} C
c. $+1.60 \times 10^{-19}$ C
d. -1.60×10^{-19} C

40. How is the charge of the proton related to the charge of the electron?

a. The magnitudes of charge of the proton and the electron are equal, but the charge of the proton is positive, whereas the charge of the electron is negative.
b. The magnitudes of charge of the proton and the electron are unequal, but the charge of the proton is positive, whereas the charge of the electron is negative.
c. The magnitudes of charge of the proton and the electron are equal, but the charge of the proton is negative, whereas the charge of the electron is positive.
d. The magnitudes of charge of the proton and the electron are unequal, but the charge of the proton is negative, whereas the charge of the electron is positive.

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45. A charge distribution has electric field lines pointing into it. What sign is the net charge?

a. positive
b. neutral
c. final
d. negative

46. If five electric field lines come out of point charge q_1 and 10 electric-field lines go into point charge q_2, what is the ratio q_1/q_2?

a. -2
b. -1
c. $-1/2$
d. 0

47. True or false—The electric-field lines from a positive point charge spread out radially and point outward.

a. false
b. true

Short Answer

18.1 Electrical Charges, Conservation of Charge, and Transfer of Charge

58. An ion of iron contains 56 protons. How many electrons must it contain if its net charge is $+5e$?

a. five electrons
b. 51 electrons
c. 56 electrons
d. 61 electrons

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67. Which electric field would produce a 10 N force in the $+x$- direction on a charge of – 10 nC ?

a. -1.0×10^9 N/C
b. 1.0×10^9 N/C
c. 1.0×10^{10} N/C
d. 1.0×10^{11} N/C

68. A positive charge is located at $x = 0$. When a negative charge is placed at $x = 10$ cm, what happens to the electric field lines between the charges?

a. "he electric field lines become denser between the charges.
b. "he electric field lines become less dense between the charges.
c. "he electric field lines remains same between the charges.
d. "he electric field lines will be zero between the charges.