Short Answer

18.1 Electrical Charges, Conservation of Charge, and Transfer of Charge 54.

Compare the mass of the electron with the mass of the proton.

a. The mass of the electron is about 1,000 times that of the proton.
b. The mass of the proton is about 1,000 times that of the electron.
c. The mass of the electron is about 1,836 times that of the proton.
d. The mass of the proton is about 1,836 times that of the electron.

55.

The positive terminal of a battery is connected to one connection of a lightbulb, and the other connection of the lightbulb is connected to the negative terminal of the battery. The battery pushes charge through the circuit but does not become charged itself. Does this violate the law of conservation of charge? Explain.

a. No, because this is a closed circuit.
b. No, because this is an open circuit.
c. Yes, because this is a closed circuit.
d. Yes, because this is an open circuit.

56.

Two flat pieces of aluminum foil lay one on top of the other. What happens if you add charge to the top piece of aluminum foil?

a. The charge will distribute over the top of the top piece.
b. The charge will distribute to the bottom of the bottom piece.
c. The inner surfaces will have excess charge of the opposite sign.
d. The inner surfaces will have excess charge of the same sign.

57.

The students in your class count off consecutively so each student has a number. The odd-numbered students are told to act as negative charge, and the even-numbered students are told to act as positive charge. How would you organize them to represent a polarized material?

a. The even-numbered and odd-numbered students will be arranged one after the other.
b. Two even-numbered will be followed by two odd-numbered, and so on.
c. Even-numbered students will be asked to come to the front, whereas odd-numbered students will be asked to go to the back of the class.
d. Half even-numbered and odd-numbered will come to the front, whereas half even-numbered and odd-numbered will go to the back.

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

59.

An insulating rod carries + 2.0\,\text{nC} of charge. After rubbing it with a material, you find it carries -3\,\text{nC} of charge. How much charge was transferred to it?

a. -5\,\text{nC}
b. -3\,\text{nC}
c. -1\,\text{nC}
d. + 2.0\,\text{nC}

60.

A solid cube carries a charge of $+8e$. You measure the charge on each face of the cube and find that each face carries $+0.5e$ of charge. Is the cube made of conducting or insulating material? Explain.

a. The cube is made of insulating material, because all the charges are on the surface of the cube.
b. The cube is made of conducting material, because some of the charges are inside the cube.
c. The cube is made of insulating material, because all the charges are on the surface of the cube.
d. The cube is made of insulating material, because some of the charges are inside the cube.

61.

You have four neutral conducting spheres and a charging device that allows you to place charge q on any neutral object. You want to charge one sphere with a charge $q/2$ and the other three with a charge $q6$. How do you proceed?

a. Charge one sphere with charge q. Touch it simultaneously to the three remaining neutral spheres.
b. Charge one sphere with charge q. Touch it to one other sphere to produce two spheres with charge $\frac{q}{2}$. Touch one of these spheres to one other neutral sphere.
c. Charge one sphere with charge q. Touch it to one other sphere to produce two spheres with charge $\frac{q}{2}$. Touch one of these spheres simultaneously to the two remaining neutral spheres.
d. Charge one sphere with charge q. Touch it simultaneously to two other neutral spheres to produce three spheres with charge $q/3$. Touch one of these spheres to one other neutral sphere.

18.2 Coulomb's law 62.

Why does dust stick to the computer screen?

a. The dust is neutral.
b. The dust is polarized.
c. The dust is positively charged.
d. The dust is negatively charged.

63.

The force between two charges is 4×10^{-9} N . If the magnitude of one charge is reduced by a factor of two and the distance between the charges is reduced by a factor of two, what is the new force between the charges?

a. 2×10^{-9} N
b. 4×10^{-9} N
c. 6×10^{-9} N
d. 8×10^{-9} N

64.

True or false—Coulomb's constant is $k = 8.99 \times 10^{9}$ N $\cdot$ m^2/C^2. Newton's gravitational constant is $G = 6.67 \times 10^{-11}$ m^3/kg s^2. This tells you about the relative strength of the electrostatic force versus that of gravity.

a. true
b. false

65.

An atomic nucleus contains 56 protons, for iron. Which force would this nucleus apply on an electron at a distance of 10×10^{-12} m?

a. 0.65×10^{-4} N
b. 0.02×10^{-4} N
c. 1.3×10^{-4} N
d. 72.8×10^{-4} N

18.3 Electric Field 66.

The electric field a distance of 10 km from a storm cloud is 1,000 N/C . What is the approximate charge in the cloud?

a. 0.0011 C
b. 11 C
c. 110 C
d. 1,100 C

67.

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

a. $-\ 1.0 \times 10^9$ 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. The electric field lines become denser between the charges.
b. The electric field lines become denser between the charges.
c. The electric field lines remains same between the charges.
d. The electric field lines will be zero between the charges.

18.4 Electric Potential 69.

The energy required to bring a charge $q = -\ 8.8$ nC from far away to 5.5 cm from a point charge Q is 13 mJ. What is the potential at the final position of q?

a. −112 MV
b. −1.5 MV
c. −0.66 MV
d. +1.5 MV

70.

How is electric potential related to electric potential energy?

a. Electric potential is the electric potential energy per unit mass at a given position in space.
b. Electric potential is the electric potential energy per unit length at a given position in space. This relation is not dimensionally correct.
c. Electric potential is the electric potential energy per unit area in space.
d. Electric potential is the electric potential energy per unit charge at a given position in space.

71.

If it takes 10 mJ to move a charge q from $x_{\mathrm{i}} = 25$ cm to $x_{\mathrm{f}} = -\ 25$ cm in an electric field of $(-20\mathrm{N/C})\hat{x}$, what is the charge q?

a. −1.0 mC
b. +0.25 mC
c. + 1.0 mC
d. +400 mC

72.

If you applied a voltage across two points A and B, how would you calculate the electric field between those points?

a. Divide the distance between the points by the voltage.
b. Divide the voltage by the distance between the points.
c. Multiply the distance between the points by the voltage.
d. Multiply the square of the distance between the points by the voltage.

18.5 Capacitors and Dielectrics 73.

If you double the voltage across the plates of a capacitor, how is the stored energy affected?

a. Stored energy will decrease two times.
b. Stored energy will decrease four times.
c. Stored energy will increase two times.
d. Stored energy will increase four times.

74.

A capacitor with neoprene rubber as the dielectric stores 0.185 mJ of energy with a voltage of 50 V across the plates. If the area of the plates is 500 cm^2, what is the plate separation?

a. 20 µm
b. 20 m
c. 80 µm
d. 80 m

75.

Explain why a storm cloud before a lightning strike is like a giant capacitor.

a. The storm cloud acts as a giant charged capacitor, as it can store a large amount of charge.
b. The storm cloud acts as a giant charged capacitor, as it contains a high amount of excess charges.
c. The storm cloud acts as a giant charged capacitor, as it splits in two capacitor plates with equal and opposite charge.
d. The storm cloud acts as a giant charged capacitor, as it splits in two capacitor plates with unequal and opposite charges.

76.

A storm cloud is 2 km above the surface of Earth. The lower surface of the cloud is approximately 2 km^2 in area. What is the approximate capacitance of this storm cloud-Earth system?

a. 9×10^{-15} F
b. 9×10^{-9} F
c. 17.7×10^{-15} F
d. 17.7×10^{-9} F