1-143-Q6

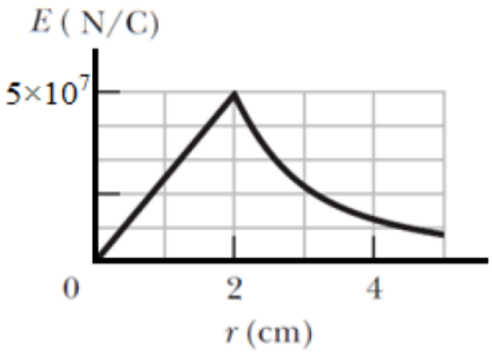
You are given a large insulating object that has a uniform charge density of 2.5 $\mu C/m^3$. Now imagine a sphere of radius 20 cm inside the material. What is the net flux through the surface of the sphere?

A) 9.5×10^3 Nm^2/C
B) Zero
C) 2.7×10^3 Nm^2/C
D) 8.1×10^3 Nm^2/C
E) It cannot be found since we do not know the size and shape of the object.

2-143-Q7

Figure 3 gives the magnitude of the electric field inside and outside sphere **A** with a positive charge distributed uniformly throughout its volume. A Gaussian spherical surface **B** is concentric with sphere **A** and has a radius of 20.0 cm. What is the net flux through surface **B**?

Fig# 3

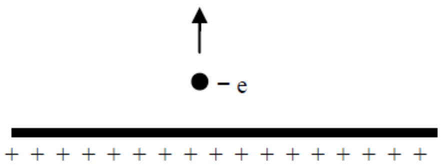


A) 2.51×10^5 Nm^2/C
B) 4.22×10^6 Nm^2/C
C) 8.21×10^4 Nm^2/C
D) 3.11×10^4 Nm^2/C
E) Zero

3-143-Q8

In **Figure 4**, an electron is shot directly away from a uniformly charged sheet. It moves with an acceleration of 2.86×10^4 m/s^2. The sheet is non-conducting, flat and very large. What is the sheet's surface charge density? Ignore the gravitational force.

Fig# 4



A) 2.88×10^{-18} C/m^2
B) 3.85×10^{-18} C/m^2
C) 9.85×10^{-18} C/m^2
D) 18.2×10^{-18} C/m^2
E) 1.21×10^{-18} C/m^2

4-143-Q9

An infinitely long line of charge carries a uniform charge per unit length of 2.5×10^{-7} C/m. The line is surrounded by an infinitely long conducting cylindrical shell of radius 2.0 cm. The shell carries a net linear charge density of -2.0×10^{-7} C/m, with the line as the axis of the shell as shown in **Figure 5**. What is the magnitude of the electric field at a distance of 1.00 cm from the line?

Fig# 5

A) 4.5×10^5 N/C
B) 8.1×10^5 N/C
C) 9.0×10^4 N/C
D) 3.6×10^5 N/C
E) 0

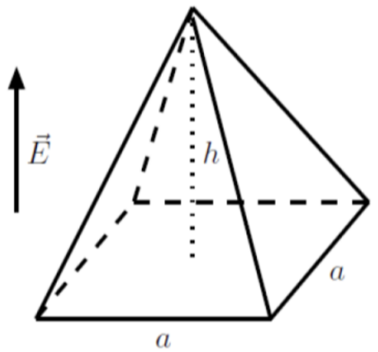
5-142-Q5

Q5. A 2.6 μC charge is at the center of a cube 7.0 cm on each side. What is the electric flux, in kN.m^2/C, through one face of the cube?

A) 49
B) 24
C) 12
D) 89
E) Zero

6-142-Q6

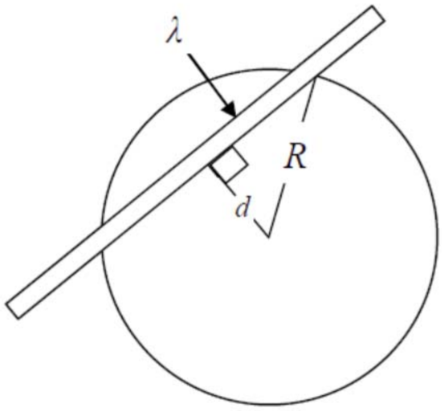
Q6. **Figure 3** shows a pyramid with horizontal square base, a = 6.00 m on each side, and a height, h = 4.00 m. The pyramid is placed in an upward vertical electric field of magnitude E = 52.0 N/C. If the pyramid does not include any charge inside, calculate the electric flux, in N.m^2/C, through its four slanted (inclined) surfaces.



A) $+1.87 \times 10^3$
B) -1.87×10^3
C) $+0.9 \times 10^3$
D) -0.9×10^3
E) -3.27×10^3

7-142-Q7

Q7. **Figure 4** show an infinitely long line of charge having a uniform charge per unit length λ. The line lies at a normal distance d from the center of a sphere of radius R ($d < R$). Determine the total electric flux through the surface of the sphere resulting from this line charge.



A) $\dfrac{2\lambda\sqrt{R^2-d^2}}{\varepsilon_o}$

B) $\dfrac{4\lambda\sqrt{R^2-d^2}}{\varepsilon_o}$

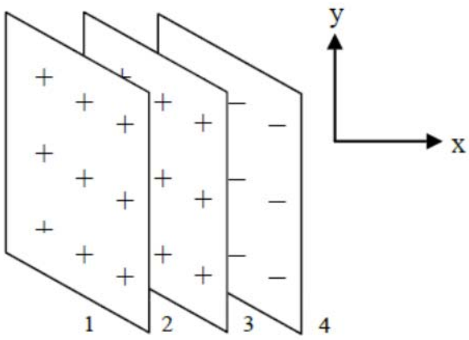
C) $\dfrac{\lambda\sqrt{R^2-d^2}}{2\varepsilon_o}$

D) $\dfrac{\lambda\sqrt{R^2-d^2}}{\varepsilon_o}$

E) $\dfrac{2\lambda\left(R^2-d^2\right)}{\varepsilon_o}$

8-142-Q8

Q8. **Figure 5** shows sections of three infinitely flat thin insulating charge sheets, each carrying surface charge density of magnitude σ. Find the magnitude of the electric field in region 3.



A) $3\sigma/2\varepsilon_0$
B) $\sigma/2\varepsilon_0$
C) $3\sigma/\varepsilon_0$
D) σ/ε_0
E) $\sigma/3\varepsilon_0$

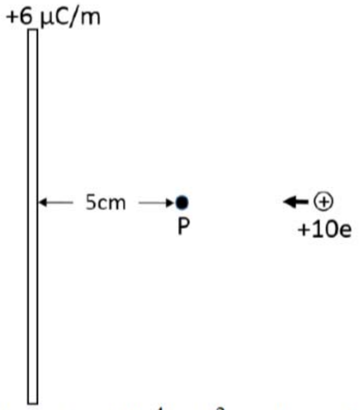
9-142-Q9

Q9. An insulating spherical ball of radius 4.0 cm has − 40 μC charge uniformly distributed throughout the volume. Find the magnitude and direction of the electric field at a point 2.0 cm from its center.

A) 1.13×10^{8} N/C towards the center
B) 1.13×10^{8} N/C away from the center
C) 0.45×10^{8} N/C towards the center
D) 0.45×10^{8} N/C away from the center
E) 3.23×10^{8} N/C towards the center

10-141-Q6

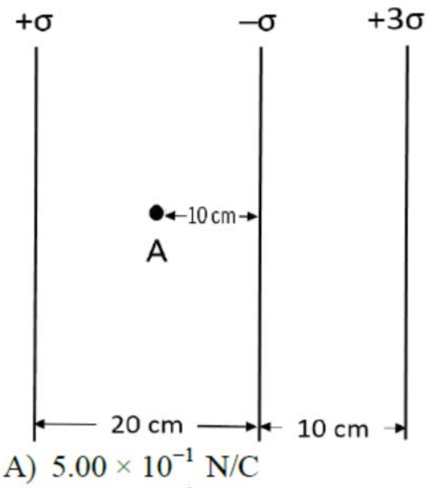
Q6. A particle of charge +10e and mass 6.0×10^{-6} g is fired directly toward a very long straight conducting wire of linear charge density +6.0 μC/m as shown in **Figure 3**. Find the magnitude and direction of acceleration of the charged particle when it reaches point P, 5.0 cm from the wire. Ignore the effect of gravity.



A) 5.8×10^{-4} m/s^2 to the right
B) 5.8×10^{-4} m/s^2 to the left
C) 2.6×10^{-6} m/s^2 to the left
D) 2.6×10^{-6} m/s^2 to the right
E) Zero

11-141-Q7

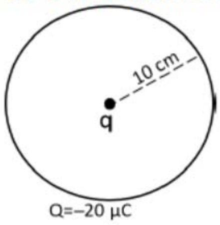
Q7. **Figure 4** shows a cross section of three large insulating sheets with their surface charge densities ($\sigma = 8.85$ pC/m^2). The magnitude of the electric field at point A is:



A) 5.00×10^{-1} N/C
B) 3.00×10^{-1} N/C
C) 1.50×10^{-1} N/C
D) 1.00×10^{-1} N/C
E) 1.30×10^{-1} N/C

12-141-Q8

Q8. An unknown charge q sits at the center of a thin conducting spherical shell of radius 10 cm which carries a charge of Q = −20 μC (see **Figure 5**). If the electric field at a point 15 cm from the center of the sphere is 1.2×10^{6} N/C radially outward, find the value of q.



A) +23 μC
B) +30 μC
C) −23 μC
D) −30 μC
E) +50 μC

13-133-Q6

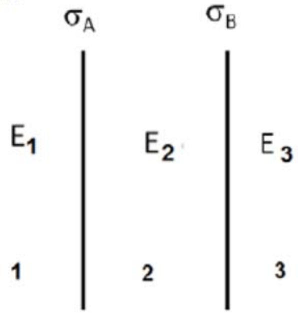
A 5.14 μC point charge is at the center of a cube with sides of length 0.25 m. What is the electric flux through one of the faces of the cube?

A) 9.68×10^{4} N.m^2/C
B) 1.81×10^{5} N.m^2/C
C) 3.68×10^{4} N.m^2/C
D) 4.68×10^{5} N.m^2/C
E) 5.35×10^{3} N.m^2/C

14-133-Q7

Two thin nonconducting sheets of charges A and B, as shown in **Figure 4**, are parallel and vertical. The sheets have surface charge densities of $\sigma_A = 3.8\times10^{-9}$ C/m^2 and $\sigma_B = -1.9 \times 10^{-9}$ C/m^2 respectively. Find the ratio (E_2/E_1) of the magnitude of the electric field in region 2 to that in region 1.

Fig#



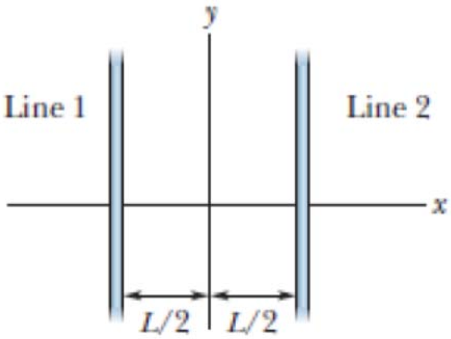
A) 3.0
B) 2.0
C) 4.0
D) 1.0
E) 5.0

15-133-Q8

Short sections of two very long parallel lines of charge, separated by $L = 8.0$ cm, as shown in **Figure 5**, are fixed in place. The uniform linear charge densities of the wires are 5.0 μC/m for line 1 and –1.0 μC/m for line 2, respectively. Where along the x axis, is the net electric field due to the two lines zero?

Fig#

A) +6.0 cm
B) −6.0 cm
C) +7.0 cm
D) −5.0 cm
E) +5.0 cm



16-133-Q9

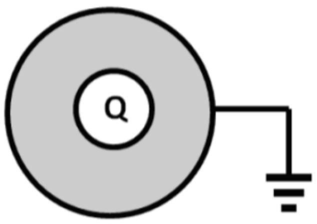
A non-conducting sphere of radius R = 7.0 cm carries a charge $Q = 4.0 \times 10^{-3}$ C distributed uniformly throughout its volume. At what distance, measured from the center of the sphere does the electric field reach a value equal to half its maximum value?

A) 3.5 cm and 9.9 cm
B) 2.5 cm and 7.9 cm
C) 4.9 cm and 8.8 cm
D) 3.5 cm and 8.1 cm
E) 5.5 cm and 9.0 cm

17-132-Q6

Q6. A metallic sphere contains a cavity at the center as shown in **Figure 4**. The outer surface of the sphere is grounded by connecting a conducting wire between it and the earth. A negative point charge $Q = -5.4 \times 10^{-9}$ C is placed inside the cavity of the sphere. What is the net electric flux through the outer surface of the metallic sphere?

Fig#

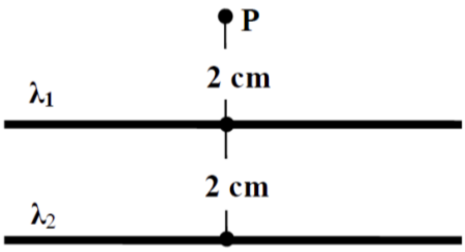


A) 0
B) $+6.1\times10^{2}$ N.m²/C
C) -6.1×10^{2} N.m²/C
D) $+3.1\times10^{2}$ N.m²/C
E) -3.1×10^{2} N.m²/C

18-132-Q7

Q7. Consider two infinitely long thin wires carrying uniform linear charge densities λ_1 and λ_2. The wires are arranged as shown in **Figure 5** and λ_2 = +5.50 nC/m**.** If the net electric field at P is zero, determine the magnitude of λ_1.

Fig#

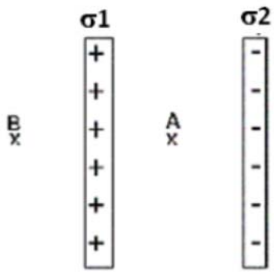


A) 2.75 nC/m
B) 1.50 nC/m
C) 1.75 nC/m
D) 2.00 nC/m
E) 0.50 nC/m

19-132-Q8

Q8. **Figure 6** shows two large, parallel, non-conducting sheets, each with fixed uniform charge density: $\sigma_1 = +2.0\times10^{-6}$ C/m^2, $\sigma_2 = -4.0\times10^{-6}$ C/m^2. The ratio of the magnitude of the electric field at point A to that at point B, (E_A/E_B), is:

Fig#

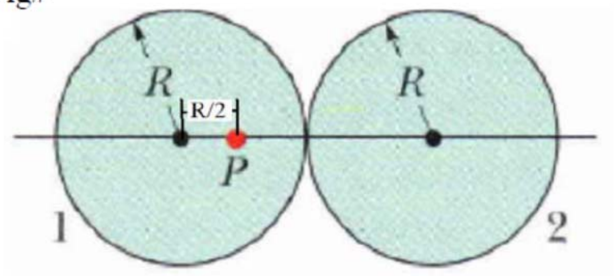


A) 3.0
B) 0.5
C) 1.0
D) 3.5
E) 1.5

20-132-Q9

Q9. **Figure 7** shows the cross sectional area of two identical charged solid spheres, 1 and 2, of radius R. The charge is uniformly distributed throughout the volumes of both the spheres. The net electric field is zero at point P, which is located on a line connecting the centers of the spheres, at radial distance R/2 from the center of sphere 1. If the charge on sphere 1 is $q_1 = 7.8\ \mu\text{C}$, determine the magnitude of the charge q_2 on sphere 2.

Fig#



A) 8.8 μC
B) 3.2 μC
C) 9.3 μC
D) 3.5 μC
E) 6.8 μC

21-131-Q6

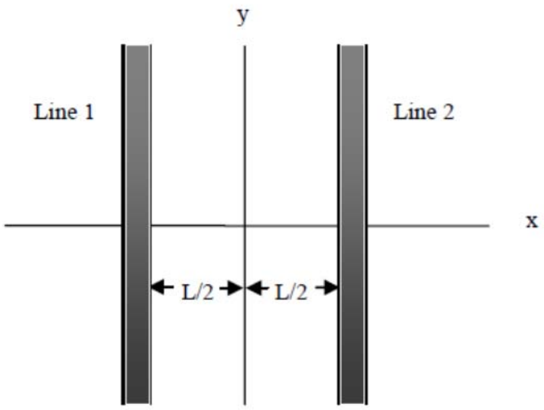
The electric field in a certain region of the Earth's atmosphere is directed vertically downward. At an altitude of 150 m, the field has a magnitude of 30 N/C. At an altitude of 100 m, the magnitude of the electric field is 50 N/C. Find the net amount of electric charge contained in a cube 50 m on edge, with horizontal faces at altitudes of 100 and 150 m.

A) 0.44 μC
B) 1.8 μC
C) 2.1 μC
D) 1.3 μC
E) 4.4 μC

22-131-Q7

In **FIGURE 2**, short sections of two very long parallel lines of charge are shown, fixed in place, and separated by $L = 10$ cm. Their uniform linear charge densities are + 8.0 mC/m for line 1, and – 4.0 mC/m for line 2. What is the x coordinate of the point at which the net electric field due to the two lines is zero.

Fig#



A) 15 cm
B) 5.0 cm
C) 20 cm
D) 25 cm
E) 10 cm

23-131-Q8

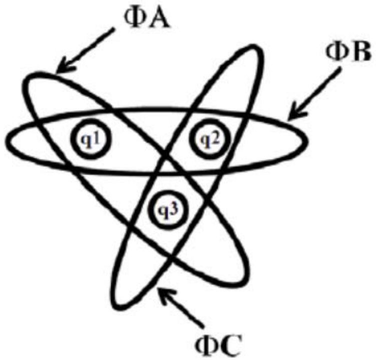
Two large, parallel, non-conducting uniformly charged sheets carry surface charge densities of + 12.0 nC/m^2 and + 5.00 nC/m^2. Determine the magnitude of the electric field at a point midway between the sheets.

A) 395 N/C
B) 960 N/C
C) 790 N/C
D) 1920 N/C
E) 565 N/C

24-123-Q6

Figure 3 shows three Gaussian surfaces A, B and C, with corresponding electric flux $\Phi_A = -q/\varepsilon_0$, $\Phi_B = +3q/\varepsilon_0$ and $\Phi_C = -2q/\varepsilon_0$ through them, respectively. What is the value of the charge q_1?

Fig#



A) +2q
B) +q
C) −3q
D) +3q
E) −2q

25-123-Q7

A charged conducting spherical shell has an inner radius of 6.0 cm and an outer radius of 10 cm. A point charge is placed at the center of the shell such that the resulting surface charge densities on the inner and outer surfaces of the shell are -100 nC/m^2 and $+100$ nC/m^2, respectively. What is the electric field at a distance of 12 cm from the center of the shell?

A) 7.9×10^3 N/C , outward
B) 7.9×10^3 N/C , inward
C) 9.7×10^3 N/C , outward
D) 9.7×10^3 N/C , inward
E) 5.3×10^3 N/C , outward

26-123-Q8

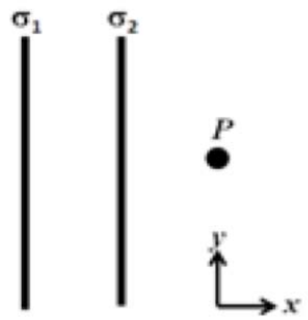
An electron experiences a force of magnitude F when it is 2 cm away from a very long, charged wire that has a uniform linear charge density $+\lambda$. If the linear charge density is increased to $+2\lambda$, at what distance from the wire will the electron experience a force of the same magnitude F?

A) 4 cm
B) 1 cm
C) 3 cm
D) 2 cm
E) 6 cm

27-123-Q9

Figure 4 shows cross sections through two large parallel non-conducting sheets with surface charge densities $\sigma_1 = -1.8\ \mu C/m^2$ and $\sigma_2 = +1.2\ \mu C/m^2$. What is the electric field at point P (in units of 10^4 N/C)?

Fig#



A) $-3.4\ \hat{\mathbf{i}}$
B) $-6.8\ \hat{\mathbf{i}}$
C) $+3.4\ \hat{\mathbf{i}}$
D) $+6.8\ \hat{\mathbf{i}}$
E) $+1.7\ \hat{\mathbf{i}}$

28-123-Q10

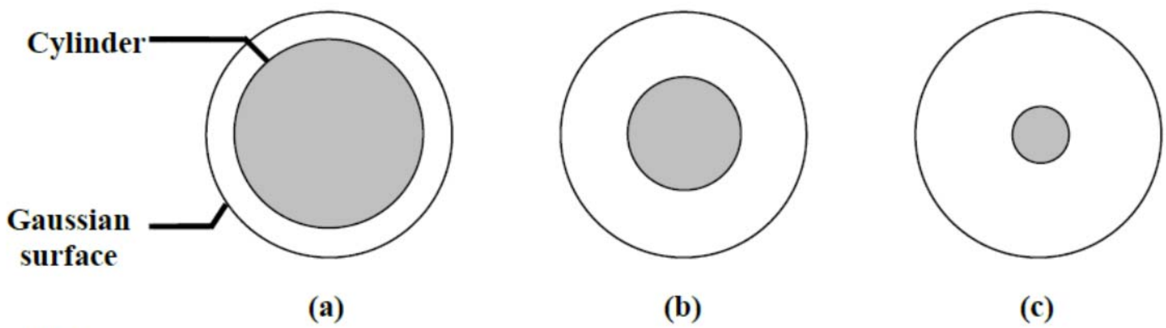
A uniformly charged solid insulating sphere has a radius of 5.0 cm. If the magnitude of the electric field due to this sphere at $r = 8.0$ cm is 2.0×10^5 N/C, what is the magnitude of the field at $r = 3.0$ cm? [r is the distance from the center of the sphere]

A) 3.1×10^5 N/C
B) 1.8×10^5 N/C
C) 9.0×10^4 N/C
D) 2.7×10^5 N/C
E) 7.2×10^5 N/C

29-122-Q5

Figure 3 a, b and c, show the cross sections of three cylinders each carrying a uniform charge Q. Concentric with each cylinder is a cylindrical Gaussian surface, all three with the same radius. Rank the Gaussian surfaces according to the electric field at any point on the surface, GREATEST FIRST.

Fig#



A) All tie
B) a, b, c
C) b, c, a
D) c, b, a
E) a, c, b

30-122-Q6

A uniformly charged conducting sphere of 3.0 cm diameter has a surface charge density of 10 $\mu C/m^2$. Find the total electric flux leaving the surface of the sphere.

A) 3.2×10^{3} $N.m^2/C$
B) 1.3×10^{4} $N.m^2/C$
C) 2.5×10^{3} $N.m^2/C$
D) 1.4×10^{5} $N.m^2/C$
E) 6.7×10^{2} $N.m^2/C$

31-122-Q7

A 6.0 μC charge is placed on a thin spherical conducting shell of radius R = 5.0 cm. A particle with a charge of -10 μC is placed at the center of the shell. The magnitude and direction of the electric field at a point 2R from the center of the shell are:

A) 3.6×10^6 N/C, toward the center
B) 3.6×10^6 N/C, away from the center
C) 0
D) 5.4×10^6 N/C, toward the center
E) 5.4×10^6 N/C, away from the center

32-122-Q8

A long, straight wire has fixed negative charge with a linear charge density of magnitude 4.5 nC/m. The wire is enclosed by a coaxial, thin walled nonconducting cylindrical shell of radius 20 cm. The shell is to have a positive charge on its outside surface (with a surface charge density σ) that makes the net **electric** field at points 30 cm from the center of the shell equal to zero. Calculate σ.

A) 3.6×10^{-9} C/m^2
B) 3.0×10^{-10} C/m^2
C) 1.5×10^{-10} C/m^2
D) 4.5×10^{-7} C/m^2
E) 7.8×10^{-5} C/m^2

33-122-Q9

Two large metal plates of area 2.0 m^2 face each other, 6.0 cm apart, with equal charge magnitudes |q| but opposite signs. The magnitude of the electric field between the plates is 1.2×10^2 N/C. Find |q|.

A) 2.1 nC
B) 1.1 nC
C) 0.50 nC
D) 13 nC
E) 0.40 nC