Ch24 (Homework)
Current Score : – / 41 **Due :** Monday, August 27 2018 01:37 PM CDT

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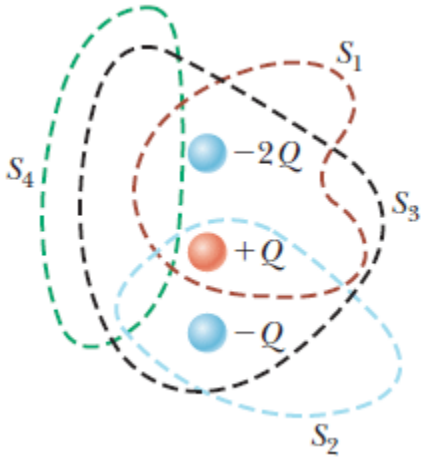
1. –/4 pointsSerPSE9 24.P.011.WI.

Four closed surfaces, S_1 through S_4, together with the charges $-2Q$, Q, and $-Q$ are sketched in the figure below. (The colored lines are the intersections of the surfaces with the page.) Find the electric flux through each surface. (Use the following as necessary: ε_0 and Q.)



Φ_{S1} = [ ] [ ]

Φ_{S2} = [ ] [ ]

Φ_{S3} = [ ] [ ]

Φ_{S4} = [ ] [ ]

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2. –/4 pointsSerPSE9 24.P.014.WI.

A particle with charge of 16.2 μC is placed at the center of a spherical shell of radius 25.5 cm.

(a) What is the total electric flux through the surface of the shell?

[ ] $N \cdot m^2/C$

(b) What is the total electric flux through any hemispherical surface of the shell?

[ ] $N \cdot m^2/C$

(c) Do the results depend on the radius?

- Yes
- No

Explain your answer.

This answer has not been graded yet.

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3. –/3 pointsSerPSE9 24.P.024.WI.

The charge per unit length on a long, straight filament is -90.2 μC/m.

(a) Find the electric field 10.0 cm from the filament, where distances are measured perpendicular to the length of the filament. (Take radially inward toward the filament as the positive direction.)

[ ] MN/C

(b) Find the electric field 23.5 cm from the filament, where distances are measured perpendicular to the length of the filament.

[ ] MN/C

(c) Find the electric field 150 cm from the filament, where distances are measured perpendicular to the length of the filament.

[ ] MN/C

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4. –/1 pointsSerPSE9 24.P.025.

A 18.6-g piece of Styrofoam carries a net charge of -0.654 μC and is suspended in equilibrium above the center of a large, horizontal sheet of plastic that has a uniform charge density on its surface. What is the charge per unit area on the plastic sheet?

[ ] $\mu C/m^2$

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5. –/4 pointsSerPSE9 24.P.029.MI.FB.

Consider a thin, spherical shell of radius 13.0 cm with a total charge of 34.0 μC distributed uniformly on its surface.

(a) Find the electric field 10.0 cm from the center of the charge distribution.

magnitude [ ] MN/C

direction ---Select---

(b) Find the electric field 25.0 cm from the center of the charge distribution.

magnitude [ ] MN/C

direction ---Select---

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6. –/1 pointsSerPSE9 24.P.036.

A particle with a charge of -60.0 nC is placed at the center of a nonconducting spherical shell of inner radius 20.0 cm and outer radius 32.0 cm. The spherical shell carries charge with a uniform density of -2.92 μC/m^3. A proton moves in a circular orbit just outside the spherical shell. Calculate the speed of the proton.

[ ] m/s

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7. –/6 pointsSerPSE9 24.P.037.MI.FB.

A long, straight metal rod has a radius of 4.90 cm and a charge per unit length of 31.2 nC/m. Find the electric field at the following distances from the axis of the rod, where distances are measured perpendicular to the rod's axis.

(a) 3.50 cm

magnitude [ ] N/C

direction ---Select---

(b) 20.0 cm

magnitude [ ] N/C

direction ---Select---

(c) 200 cm

magnitude [ ] N/C

direction ---Select---

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8. –/4 pointsSerPSE9 24.P.044.

A square plate of copper with 55.0 cm sides has no net charge and is placed in a region of uniform electric field of 82.0 kN/C directed perpendicularly to the plate.

(a) Find the charge density of each face of the plate.

[ ] nC/m^2

[ ] nC/m^2

(b) Find the total charge on each face.

[ ] nC

[ ] nC

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9. –/4 pointsSerPSE9 24.P.045.

A long, straight wire is surrounded by a hollow metal cylinder whose axis coincides with that of the wire. The wire has a charge per unit length of λ, and the cylinder has a net charge per unit length of 2λ. From this information, use Gauss's law to find the following. (Use any variable or symbol stated above along with the following as necessary: ε_0 and π.)

(a) the charge per unit length on the inner surface of the cylinder

λ_{inner} =

(b) the charge per unit length on the outer surface of the cylinder

λ_{outer} =

(c) the electric field outside the cylinder a distance *r* from the axis

E =

magnitude

direction ---Select---

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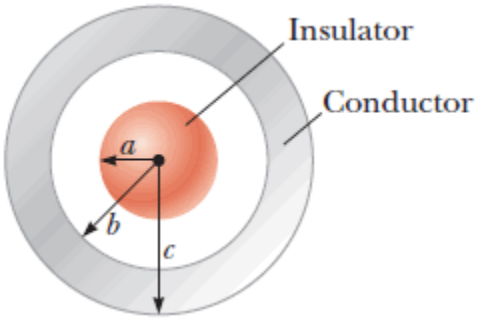
10. –/8 pointsSerPSE9 24.P.054.

A solid, insulating sphere of radius a has a uniform charge density throughout its volume and a total charge of Q. Concentric with this sphere is an uncharged, conducting hollow sphere whose inner and outer radii are b and c as shown in the figure below. We wish to understand completely the charges and electric fields at all locations. (Use the following as necessary: Q, ε_0, a, b, c and r. Do not substitute numerical values; use variables only.)



(a) Find the charge contained within a sphere of radius $r < a$.

q_{in} =

(b) From this value, find the magnitude of the electric field for $r < a$.

E =

(c) What charge is contained within a sphere of radius r when $a < r < b$?

q_{in} =

(d) From this value, find the magnitude of the electric field for r when $a < r < b$.

E =

(e) Now consider r when $b < r < c$. What is the magnitude of the electric field for this range of values of r?

E =

(f) From this value, what must be the charge on the inner surface of the hollow sphere?

Q_{inner} =

(g) From part (f), what must be the charge on the outer surface of the hollow sphere?

Q_{outer} =

(h) Consider the three spherical surfaces of radii a, b, and c. Which of these surfaces has the largest magnitude of surface charge density?

- surface a
- surface b
- surface c

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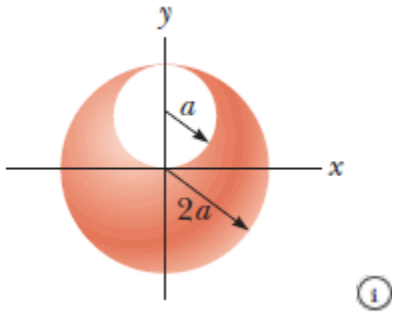
11. –/0 pointsSerPSE9 24.P.064.

A sphere of radius $2a$ is made of a nonconducting material that has a uniform volume charge density ρ. Assume that the material does not affect the electric field. A spherical cavity of radius a is now removed from the sphere as shown in the figure below. Show that the electric field within the cavity is uniform and is given by $E_x = 0$ and $E_y = \rho a/3\varepsilon_0$. (Submit a file with a maximum size of 1 MB.)



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This answer has not been graded yet.

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12. –/2 pointsSerPSE9 24.P.065.

A spherically symmetric charge distribution has a charge density given by $\rho = a/r$, where a is constant. Find the electric field within the charge distribution as a function of r. *Note*: The volume element dV for a spherical shell of radius r and thickness dr is equal to $4\pi r^2 dr$. (Use the following as necessary: a, r, and ε_0. Consider that a is positive.)

$\vec{E}$ =

magnitude

direction ---Select---

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