CENGAGE | WEBASSIGN

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← PHYS 2401, section 201, Summer 2 2022

Gauss's Law (Homework)

INSTRUCTOR
Keith West
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Current Score

QUESTION	1	2	3	4	5	6	7	8	9
POINTS	–/3	–/4	–/1	–/4	–/2	–/1	–/8	–/8	–/1

TOTAL SCORE

–/32 0.0%

Due Date

THU, AUG 4, 2022
11:58 PM CDT

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Assignment Submission & Scoring

Assignment Submission

For this assignment, you submit answers by question parts. The number of submissions remaining for each question part only changes if you submit or change the answer.

Assignment Scoring

Your last submission is used for your score.

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1. **[–/3 Points]** DETAILS **SERPSE10 23.2.OP.008.MI.**

MY NOTES | ASK YOUR TEACHER | PRACTICE ANOTHER

An electric field of magnitude 2.86 kN/C is applied along the *x* axis. Calculate the electric flux through a rectangular plane 0.350 m wide and 0.700 m long if the following conditions are true.

(a) The plane is parallel to the *yz* plane.

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

(b) The plane is parallel to the *xy* plane.

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

(c) The plane contains the *y* axis, and its normal makes an angle of 36.8° with the *x* axis.

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

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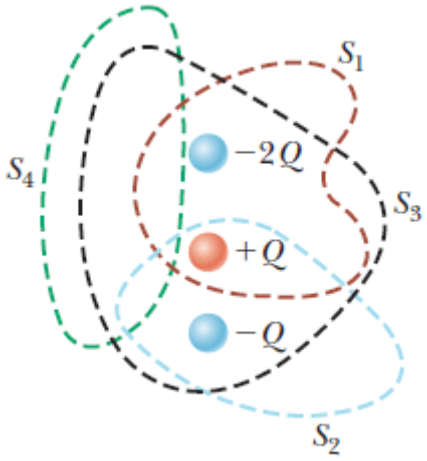
2. [–/4 Points] DETAILS SERPSE10 23.3.P.015.

MY NOTES ASK YOUR TEACHER

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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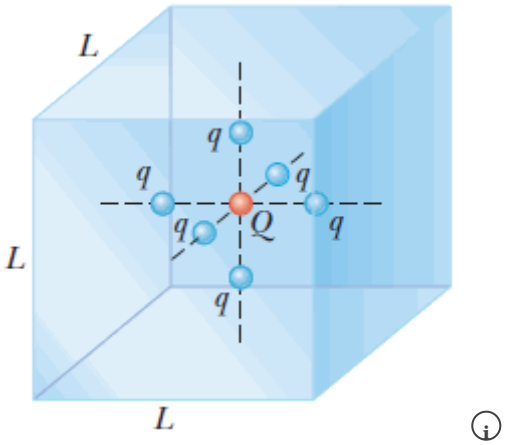
3. [–/1 Points] DETAILS SERPSE10 23.3.P.019.

MY NOTES ASK YOUR TEACHER PRACTICE ANOTHER

A particle with charge Q = 5.50 μC is located at the center of a cube of edge L = 0.180 m. In addition, six other identical charged particles having q = −0.5 μC are positioned symmetrically around Q as shown in the figure below. Determine the electric flux through one face of the cube.



kN · m^2/C

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4. [–/4 Points] DETAILS SERPSE10 23.4.OP.016.MI.

MY NOTES ASK YOUR TEACHER PRACTICE ANOTHER

Consider a thin, spherical shell of radius 13.0 cm with a total charge of 29.2 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 21.0 cm from the center of the charge distribution.

magnitude [ ] MN/C

direction ---Select---

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5. [–/2 Points] DETAILS SERPSE10 23.4.P.034.

MY NOTES ASK YOUR TEACHER PRACTICE ANOTHER

A cylindrical shell of radius 7.00 cm and length 2.55 m has its charge uniformly distributed on its curved surface. The magnitude of the electric field at a point 20.8 cm radially outward from its axis (measured from the midpoint of the shell) is 36.0 kN/C.

(a) Find the net charge on the shell.

[ ] nC

(b) Find the electric field at a point 4.00 cm from the axis, measured radially outward from the midpoint of the shell.

[ ] kN/C

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6. [–/1 Points] DETAILS SERPSE10 24.6.OP.031.

MY NOTES ASK YOUR TEACHER PRACTICE ANOTHER

An astronaut conducts an experiment aboard the International Space Station, in a environment of apparent weightlessness. The scientist places a charge of 59.0 μC on a conducting sphere with a 3.00 cm radius. A second, identical conducting sphere, initially neutral, is then attached to the first with a very light, thin, 1.60 m long conducting wire. Once the system of the spheres and wires reach equilibrium, what is the tension in the wire? (Give your answer in N. Assume the surface distribution of charge on each sphere is uniform.)

[ ] N

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7. [–/8 Points] DETAILS SERPSE10 24.6.P.034.MI.

MY NOTES ASK YOUR TEACHER PRACTICE ANOTHER

A solid conducting sphere of radius 2.00 cm has a charge of 7.96 μC. A conducting spherical shell of inner radius 4.00 cm and outer radius 5.00 cm is concentric with the solid sphere and has a charge of −2.48 μC. Find the electric field at the following radii from the center of this charge configuration.

(a) r = 1.00 cm

magnitude [ ] N/C

direction ---Select---

(b) r = 3.00 cm

magnitude [ ] N/C

direction ---Select---

(c) r = 4.50 cm

magnitude [ ] N/C

direction ---Select---

(d) r = 7.00 cm

magnitude [ ] N/C

direction ---Select---

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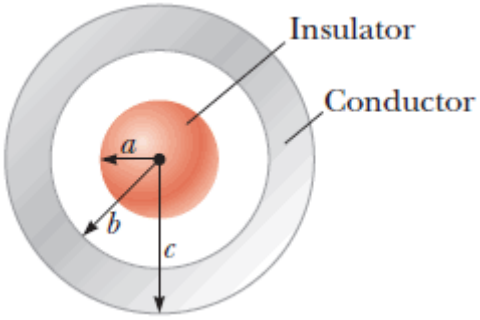
8. [–/8 Points] DETAILS SERPSE10 24.A.P.045.

MY NOTES ASK YOUR TEACHER

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. (Assume Q is positive. 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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9. **[–/1 Points]** DETAILS **SERPSE10 23.C.P.051.**

MY NOTES ASK YOUR TEACHER

A solid insulating sphere of radius R has a nonuniform charge density that varies with r according to the expression $\rho = Ar^2$, where A is a constant and $r < R$ is measured from the center of the sphere. (Submit a file with a maximum size of 1 MB.)

(a) Show that the magnitude of the electric field outside ($r > R$) the sphere is $E = \dfrac{AR^5}{5\epsilon_0 r^2}$.

(b) Show that the magnitude of the electric field inside ($r < R$) the sphere is $E = \dfrac{Ar^3}{5\epsilon_0}$. *Note*: The volume element dV for a spherical shell of radius r and thickness dr is equal to $4\pi r^2 dr$.

Choose File No file chosen

This answer has not been graded yet.

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