Welcome to the homework page test1. If this isn't you then please go back to the homework login page.

You may log out and return later if you wish without losing any saved data. You will have **TEN** attempts for each assigned problem. Every unsuccessful attempt will lower that part of the problem's value by 5%.

For example, if you get it right on the first try, then you will receive 100% for that problem. If you are twice incorrect and submit the correct on the third try, then you will receive a 90% for that part of the problem. You will not recieve any points for that part of the problem after 10 attempts.

You do not have to answer all the problems during a single session or in any particular order. To answer a problem simply type the numerical value in the box provided, check the box to the right of the part(s) you want to answer, and then click the submit button. You can freely log in and out of the homework page without losing any submitted information so feel free to take breaks if necessary.

$\oint \vec{E}\cdot d\vec{A} = \frac{Q_{ENC}}{\epsilon_0}$ $\quad 4\pi R^2 E(R) = \frac{Q_{ENC}(R)}{\epsilon_0}$

LET'S BEGIN!

Problem #1

a) r_1 INSIDE SPHERE: $Q_{ENC} = \frac{4}{3}\pi r_1^3 \rho$

SO $E(r_1) = \frac{r_1 \rho}{3\epsilon_0} = \frac{(0.52)(3.40\times10^{-11})}{3(8.85\times10^{-12})}$

A sphere of radius R = 79.0cm is an insulator into which has been placed a uniform (volumetric) charge density of $\rho = 3.40\times10^{-11}$C/m^3. Determine the electric field at the radial distance (a) r_1 = 52.0cm and (b) r_2 = 90.0cm from the center of the sphere. (Take the permittivity of free space to be $\epsilon_0 = 8.854\times10^{-12}$F/m.)

a) (CON'T) SO $\boxed{E(r_1) = 0.666}$

(a) 0.666 N/C $\hat{r}$ ☑ Answer part (a)

(b) 0.78 N/C $\hat{r}$ ☑ Answer part (b)

b) r_2 OUTSIDE RADIUS OF SPHERE

$\Rightarrow Q_{ENC}$ USE THE TOTAL CHARGE OF SPHERE $Q_{TOT} = \frac{4}{3}\pi(0.79)^3\rho = 7.02\times10^{-11}$ C

Submit

Attempted part (a) 0 times and part (b) 0 times.

There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

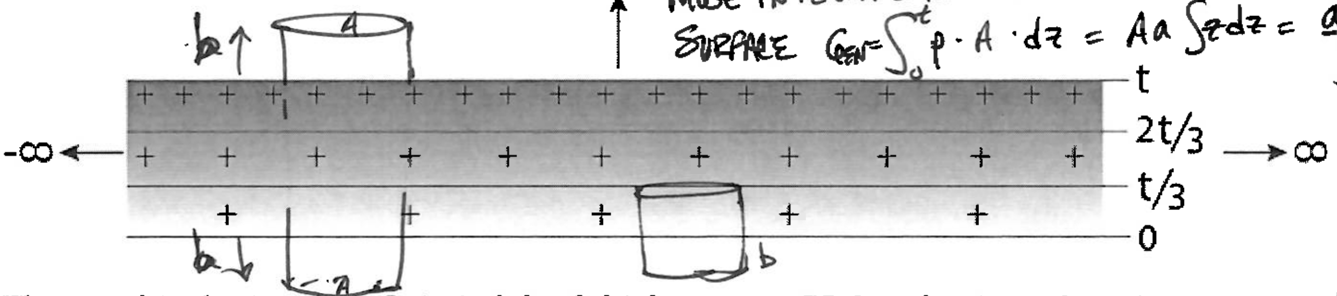
$\Rightarrow$ FOR (b)

$E(r_2) = \frac{Q_{ENC}}{4\pi\epsilon_0 r_2^2} = \frac{k Q_{ENC}}{r_2^2} = \frac{(9\times10^9)(7.02\times10^{-11})}{(0.90)^2}$

SO $\boxed{E(r_2) = 0.78}$

Problem #2

IDEA HERE IS TO DO THIS IN TWO STEPS. FIRST USE SYMMETRY OF $\vec{E}$ FOR A GAUSSIAN CYLINDER → BOTH ENDS OUTSIDE THE CHARGE SLAB: THEN $\oint \vec{E}\cdot d\vec{A} = 2A E(b) = \frac{Q_{ENC}}{\epsilon_0}$. TO FIND Q_{ENC} ONE MUST INTEGRATE THE CHARGE DENSITY IN THE GAUSSIAN SURFACE $Q_{enc} = \int_0^t \rho \cdot A \cdot dz = Aa\int z\,dz = \frac{aAz^2}{2}\Big]_0^t$



The graphic depicts a (infinite) slab of thickness t = 75.0cm having a location-dependent (volumetric) charge density of ρ = a·z the slab extent along the z-axis is 0 to t and the coefficient 'a' is measured as a = 6.30×10^{-10}C/m^4. For the infinite slab, the z-component of the electric field is the only nonzero component, and we take the verticle axis to be the z-axis. Find the electric field (a) below the slab, (b) at t/3, (c) at 2t/3, and (d) above the slab.

So $Q_{ENC} = aAt^2/2 = \frac{(6.3\times10^{-10})(0.75)^2 A}{2} = 1.77\times10^{-10}A$

$\Rightarrow 2AE(b) = \frac{1.77\times10^{-10}A}{\epsilon_0}$

$E(b) = 10.01$ N/C, INDEP OF b

SAME ANS. FOR (a) & (d)

(a) 10.01 N/C $\hat{z}$ Answer part (a)

(b) -7.79 N/C $\hat{z}$ Answer part (b)

(c) -1.17 N/C $\hat{z}$ Answer part (c)

POINTS DOWN (d) -10.01 N/C $\hat{z}$ Answer part (d)

SIGN

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FOR PARTS b,c NEED A DIFFERENT GAUSSIAN SURFACE, SHOWN ABOVE. IT ENDS @ t/3, BUT STICKS OUTSIDE. THEN $\oint \vec{E}\cdot d\vec{A} = AE(t/3) + AE(b)$

& $Q_{ENC} = \int \rho A\,dz = \frac{aAt^2}{2}\Big]_0^{t/3} = \frac{aAt^2}{18} = 1.96\times10^{-11}A$ $\Rightarrow \oint \vec{E}\cdot d\vec{A} = Q_{en}/\epsilon_0 \Rightarrow AE(t/3) + AE(b) = 2.21A$

USING $E(b) = 10.01 \Rightarrow$ $E(t/3) = -7.79$, SO POINTS DOWN AS EXPECTED

Attempted part (a) 0 times, part (b) 0 times, part (c) 0 times, and part (d) 0 times.

There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

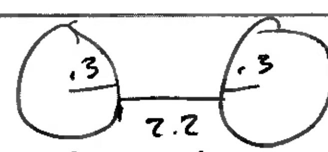
There have been no attempts to answer part (c)

There have been no attempts to answer part (d)

SIMILARLY FOR (C), $Q_{ENC} = \frac{4aAt^2}{18}$

$E(2t/3) = -1.17$

Problem #3



Two spheres are metal and have the same radius R = 30.0cm. They can be connected by a wire (length L = 2.20m), but initially the wire is not connected when a charge of

Q = 48.0μC is placed on one of the spheres. Then, the wire is then connected. (a) What is the charge in the second sphere a short while after the wire is connected? (b) Assuming that the charges are approximately uniformly distributed over the spheres after the wire is reconnected, then what is the magnitude of the tension in the wire?

(a) 24.0 ~~μC~~ μC Answer part (a)

(b) 0.661 N Answer part (b)

Submit

d IS DISTANCE BETWEEN CENTERS!!

a) SINCE IDENTICAL, EXPECT EQUAL AMOUNT OF CHARGE ON EACH, BY SYMMETRY.

b) $F = \frac{KQ_1Q_2}{d^2} = \frac{(9\times10^9)(24\times10^{-6})^2}{(2.2+.6)^2}$

$F = 0.661N$

Attempted part (a) 0 times and part (b) 0 times.

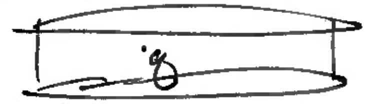
There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

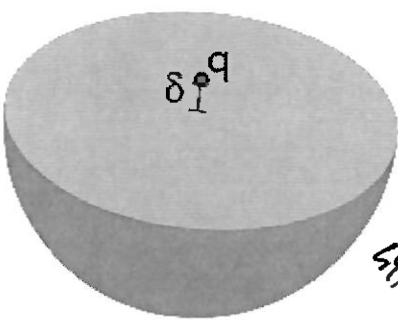
Problem #4

a) CONSIDER A VERY FLAT "TUNA CAN" AROUND q, ONE FACE OF WHICH IS THE CIRCLE SHOWN

$\oint \vec{E}\cdot d\vec{A} = q/\epsilon_0$



& SAME TOP & BOTTOM. (EDGE IS SO SMALL, YOU CAN NEGLECT IT) $\Rightarrow \oint E\cdot dA = q/2\epsilon_0$ ONE FACE.



So b) ANS. IS −5.93

− SINCE ITS GOING INTO THE SURFACE

A hemispherical volume has a point charge, q = 1.05nC, placed a small distance δ above the center of the flat surface, where δ→0. (a) What is the flux through the curved surface of the hemisphere? (b) What is the flux through the flat surface? (Assume that field lines leaving the hemisphere give positive flux and lines entering the hemisphere give negative flux.)

(a) +5.93 Nm^2/C Answer part (a)

(b) −5.93 Nm^2/C Answer part (b)

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FOR (a) AGAIN ITS ½ FLUX FROM CHARGE, AS IN (b)

SAID ANOTHER WAY, THERES NO CHARGE IN HEMISPHERICAL VOLUME SO

$Q_{ENC}/\epsilon_0 = 0 = \oint \vec{E}\cdot d\vec{A} = \underbrace{\oint E\cdot dA}_{\text{FLAT CIRCLE}} + \underbrace{\int E\cdot dA}_{\text{HEMISPHERE}}$

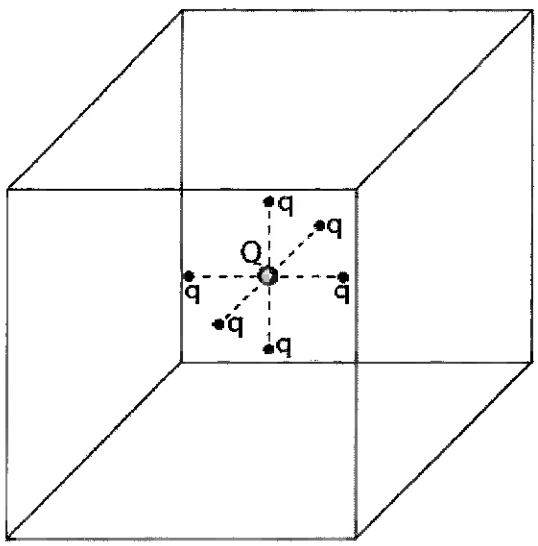
SO MUST BE EQUAL MAGNITUDE & OPPOSITE SIGN

Attempted part (a) 0 times and part (b) 0 times.

There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

Problem #5



BY SYM. $\oint E\cdot dA = 6\int_{FACE} E\cdot dA$

ALL FACES SAME.

ALSO $\oint E\cdot dA = \frac{Q_{ENC}}{\epsilon_0} = \frac{(-5.2+6(1.3))nC}{\epsilon_0}$

$= 293.8$

A cube of sidelength L = 1.10m encloses a charge Q = -5.20nC that is surrounded by six charges of q = 1.30nC that are symmetrically placed along the axial dimensions of the cube. What is the electric flux through the right side of the cube?

48.96 Nm^2/C Answer the question

SO $\int_{\text{ONE FACE}} E\cdot dA = \frac{293.8}{6}$

$= 48.96$

Submit

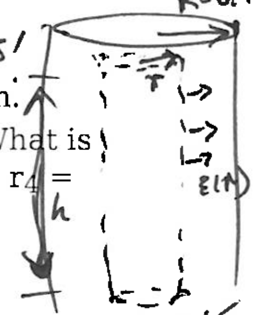
Attempted the problem 0 times.

There have been no attempts to answer the problem

Problem #6

THIS IS SCHEMATICALLY JUST LIKE THE UNIFORMLY CHARGED SPHERE, PROBLEM #1 (a),(b) ARE INSIDE (c) (d) ARE OUTSIDE.

TAKE AS GAUSSIAN SURFACES CYLINDERS, SINCE $\vec{E}$ POINTS OUT!



A cylinder (straight and assumed to be infinitely long) is of radius R = 70.0cm. Throughout its volume is placed a uniform charge density ρ = 0.125nC/m^3. What is the electric field at (a) r_1 = 41.0cm, (b) r_2 = 52.0cm, (c) r_3 = 81.0cm, and (d) r_4 = 94.0cm? Use cylindrical coordinates (r,φ,z).

THEN $\oint \vec{E}\cdot d\vec{A} = 2\pi r h E(r)$

$= Q_{ENC}/\epsilon_0$

(a) 2.896 N/C $\hat{r}$ Answer part (a)

BUT $Q_{ENC} = \rho \cdot Vol$

$= \rho\cdot \pi r^2 h$

SO $2\pi r \cancel{h} E(r) = \frac{\rho \pi r^2 \cancel{h}}{\epsilon_0}$

FOR $r<R$: (a)(b)

SO FOR (a),(b) $r<R$ $E(r) = \frac{\rho r}{2\epsilon_0}$

FOR (c)(d) $r>R$ $E(r) = \frac{\rho R^2}{2\epsilon_0 r}$

So Plugging #s.

(a) $E(r) = \frac{\rho r}{2\epsilon_0} = \frac{(0.125\times10^{-9})(0.41)}{2(8.85\times10^{-12})}$
$= \boxed{2.8955}$

(b) 3.67 N/C $\hat{r}$ ✓ Answer part (b)

(b) $E(r) = \frac{(0.125\times10^{-9})(0.52)}{2(8.85\times10^{-12})} = 3.67$

(c) 4.27 N/C $\hat{r}$ ✓ Answer part (c)

(c) $E(r) = \frac{\rho R^2}{2\epsilon_0 r} = \frac{(0.125\times10^{-9})(.7)^2}{2(8.85\times10^{-12})(0.81)} =$
$\boxed{= 4.27}$

(d) 3.68 N/C $\hat{r}$ ✓ Answer part (d)

Submit

Attempted part (a) 0 times, part (b) 0 times, part (c) 1 times, and part (d) 0 times.

(d) $E(r) = \frac{(0.125\times10^{-9})(.7)^2}{2(8.85\times10^{-12})(0.94)}$
$\boxed{= 3.681}$

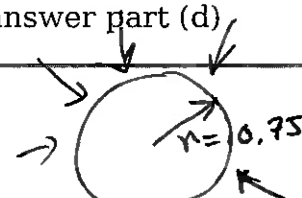
There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

Part (c) has been answered correctly

There have been no attempts to answer part (d)

Problem #7



An electric field (assumed uniform) points inward towards a spherical surface of r = 75.0cm, which encloses a charge. The magnitude of the electric field at any location on the surface is measured to be $|\mathbf{E}| = 82.5$N/C. if no other charges are present outside sphere, then what is the net charge inside the closed spherical surface?

-5.161 nC ✓ Answer the question

$\oint \vec{E}\cdot d\vec{A} = -4\pi r^2 |E| = -583 \frac{Nm^2}{C}$

Note – since it's pointing INWARD ($d\vec{A}$ points out!)

& by Gauss: $\oint \vec{E}\cdot d\vec{A} = Q_{enc}/\epsilon_0 \Rightarrow Q_{enc} = -583\,\epsilon_0$

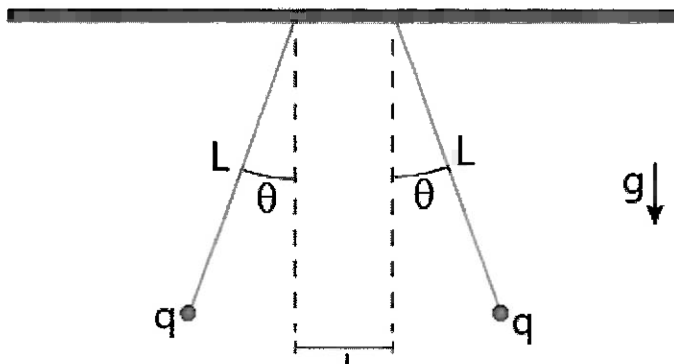
Submit

Attempted the problem 0 times.

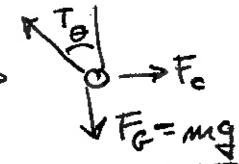
$Q_{enc} = -5.161\times10^{-9}\,C$
$\boxed{= -5.161\,nC}$

There have been no attempts to answer the problem

Problem #8



DRAW FBD OF BALLS



$F_G = mg$
$= .053(9.8)$
$F_G = 0.52N$

$\vec{a} = 0 \Rightarrow \sum \vec{F} = 0$

$\Rightarrow T S_\theta = F_c \qquad T C_\theta = F_G$

$\frac{kq^2}{x^2}$

$\vdash$ — x — $\dashv$ x IS TOTAL CHARGE-CHARGE DISTANCE $= L$

Little spheres (shown hanging from insulating threads of length 11.0cm) have the same mass (0.0530kg) and a charge is placed on the pair so that it is evenly distributed between them. They are hung a distance d = 7.20cm from each other (as shown) on the ceiling. Compute the magnitude of the charge on a single sphere if they hang at an angle of (a) θ = 10.0° and (b) θ = 16.0°?

(a) 0.291 μC ☑ Answer part (a)

(b) 0.541 μC ☑ Answer part (b)

Submit

Attempted part (a) 0 times and part (b) 0 times.

There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

NOTE FOR PART (a) $\theta = 10°$, $x = d + 2L S_\theta = .072 + 2(.11)S_{10} = 0.0911$

$T = F_G / C_\theta = 0.528N$ THEN $T S_\theta = \frac{kq^2}{x^2}$ $\quad q^2 = \frac{x^2 T S_\theta}{k}$

a) $q^2 = \frac{(0.0911)^2 (0.528) S_{10}}{9 \times 10^9} = 8.45 \times 10^{-14} \Rightarrow \boxed{q = 2.91 \times 10^{-7} C}$

b) $\theta = 16$ $\quad x = d + 2L S_{16} = 0.133$

$T = F_G / C_{16} = 0.541$

$q^2 = \frac{x^2 T S_{16}}{k} = 2.931 \times 10^{-13}$

$\Rightarrow \boxed{q = 5.41 \times 10^{-7} C}$