= KEY =

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

HW #3

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.

LET'S BEGIN!

Problem #1

$E = \frac{kQ}{x^2}$ $V = \frac{kQ}{x}$

A evenly charged sphere causes the magnitude of the electric field somewhere outside to be 475V/m. At that same place the electric potential is 3.10kV (note 'kV' means kilovolts). (a) How far is this place from the center of the object? (b) What is the magnitude of the charge?

(a) ⇒ SOLVE FOR X.

NOTE $\frac{V}{E} = x = \frac{3100}{475} = 6.53$

(a) 6.53 m ☑ Answer part (a)

(b) 2.25 μC ☑ Answer part (b)

(b) NOW THAT WE KNOW X, WE CAN GO BACK & SOLVE FOR Q.

$V = \frac{kQ}{x} \Rightarrow Q = \frac{Vx}{k} = \frac{(3100)(6.53)}{9\times10^9}$

$\Rightarrow \boxed{Q = 2.25\times10^{-6}\,C}$

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)

$V = -\int \vec{\mathcal{E}} \cdot d\vec{\ell}$

$\Rightarrow \vec{\mathcal{E}} = -\vec{\nabla} V$

Problem #2

$\mathcal{E}_x = -\frac{dV}{dx} = (-x - 0.75x^2)(-1)$

The electric potential along the x-direction due to an unevenly charged structure has, as a function of distance 'x', the potential V(x) = 1.00 V - (0.500 V/m^2)x^2 - (0.250 V/m^3)x^3. Compute the electric field at x= (a) 25.0cm, and (b) x= 55.0cm, (c) 73.0cm, and (d) 1.05m?

(a) 0.297 N/C Answer part (a)

a) $V(0.25) = +0.25 + 0.75\,(0.25)^2$
$= +0.297$

(b) N/C Answer part (b)

(c) N/C Answer part (c)

REST SAME ... JUST PLUG IN x = ...

(d) N/C Answer part (d)

INTO $\mathcal{E}_x = x + 0.75x^2$

Submit

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

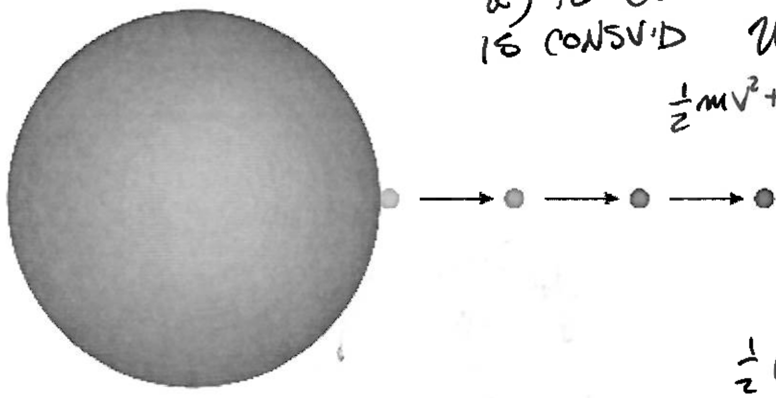
There have been no attempts to answer part (a)

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)

Problem #3



a) TO GET TO ∞, $V(\infty) = 0$ SO SINCE ENERGY IS CONSV'D $U_{SURFACE} = U_{\infty}$

$\frac{1}{2}mv^2 + \frac{kQ(q)}{R} = 0$ IF JUST MAKES IT OUT FAR AWAY W/ ESSENTI[ALLY] NO VELOCITY.

SO $\frac{1}{2}mv^2 = -\frac{kQq}{R}$

$= -\frac{(9\times10^9)(-355\times10^{-6})(4.2\times\ldots)}{(2.3)^2}$

$\frac{1}{2}(0.011)v^2 = 0.0025 \Rightarrow v = 0.679$ m/s

A spherical object with radius R = 2.30cm and net charge Q = --355μC throws out from its surface a charged (positive) chunk of mass m = 11.0g and charge q = 4.20nC. (a) What must be the initial velocity of ejection for the chunk to escape the large object's Coulomb potential (escape velocity...that is, the minimum initial velocity at the surface for the chunk to go infinitely far away). (b) What was the kinetic energy at the surface when traveling at this escape velocity?

(a) 0.679 m/s ☑ Answer part (a)

b) $\frac{1}{2}mv^2$, BUT THAT - OF P.E. $= 0.0025$ J

(b) 0.0025 J ☑ 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)

Problem #4

CHOOSE A CO-ORD ALONG CHARGE.

$dq = \lambda\, dx$ w/ $\lambda = \frac{Q}{L} = 5.92\times10^{-9}\ \frac{C}{M}$ CHARGE PER UNIT LENGTH

$V = \int dV = \int \frac{k\,dq}{s} = k\lambda \int_0^l \frac{dx}{\sqrt{(x-x_0)^2+y_0^2}}$

$y_0 = a$, BUT (a) FOR P, $x_0 = l/3$ FOR (b) S., $x_0 = l/2$ SO

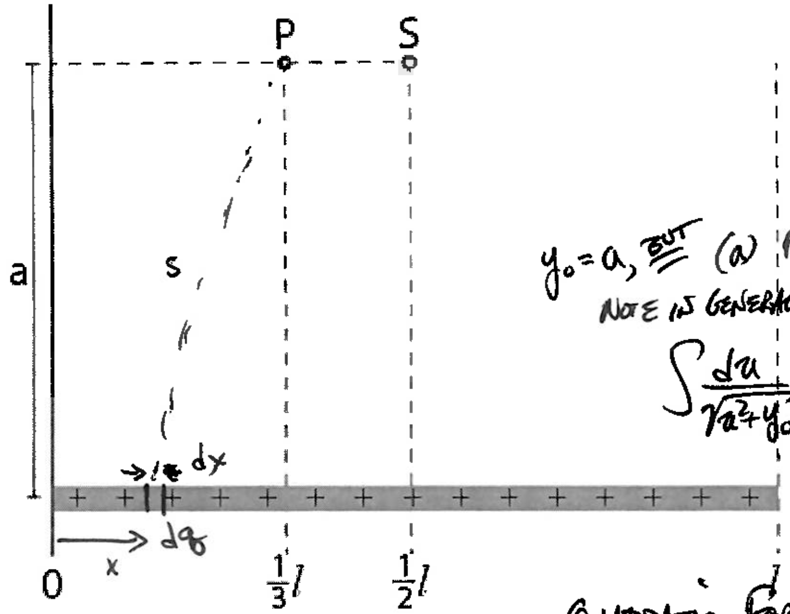
NOTE IN GENERAL, $u = x - x_0$ $du = dx$ LET $u = y_0 \sinh w$, $du = y_0 \cosh w\, dw$ & $1+\sinh^2 w = \cosh^2 w$

$\int \frac{du}{\sqrt{u^2+y_0^2}} = \int \frac{\cosh w\, dw}{\cosh w} = w$

SO NOTE $\frac{u}{y_0} = \sinh w = \frac{e^w - e^{-w}}{2}$

$\Rightarrow e^{2w} - 2\left(\frac{u}{y_0}\right)e^w - 1 = 0 \Rightarrow$

QUADRATIC FORMULA: $e^w = \frac{u}{y_0} \pm \sqrt{\left(\frac{u}{y_0}\right)^2+1}$ − SIGN HAS PROBLEMS, TAKE + SIGN!



A rod of length ℓ = 1.20m and uniform charge Q = 7.10nC is positioned along the x-axis. As depicted in the above diagram, two points are located a distance a = 1.10m away from the rod in the y-direction. Point P is located a distance of $\ell/3$ from the end of the rod in the x-direction and point S is located a distance of $\ell/2$ from the end of the rod in the x-direction. Calculate the electric potential at (a) point P and (b) point S.

SO $\int \frac{du}{\sqrt{u^2+y_0^2}} = \ln\left(\frac{u}{y_0}+\sqrt{\left(\frac{u}{y_0}\right)^2+1}\right)$ SO

(a) 54.93 V Answer part (a)

(b) 55.60 V Answer part (b)

Submit

a) $V(P) = k\lambda \ln\left(\frac{x-x_0}{a}+\sqrt{\left(\frac{x-x_0}{a}\right)^2+1}\right)\Big]_0^l$

w/ $x_0 = l/3 = 0.4$ $a = 1.1$

$V(P) = (9\times10^9)(5.92\times10^{-9})\left[\ln\left(\frac{.8}{1.1}+\sqrt{\left(\frac{.8}{1.1}\right)^2+1}\right) - \ln\left(\frac{.4}{1.1}+\sqrt{\left(\frac{.4}{1.1}\right)^2+1}\right)\right]$

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

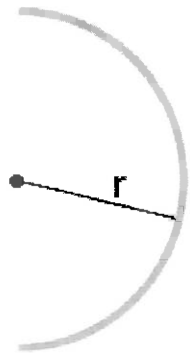
$V(P) = 53.3(1.031) = \boxed{54.93\text{ VOLTS}}$

There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

Problem #5

b) $V(S) = 53.3(1.043) = \boxed{55.6\text{ VOLTS}}$



$V = \sum V_i = \frac{k}{r}\sum dq = \frac{kQ}{r}$

$V = \frac{(9\times10^{9})(-1.7\times10^{-9})}{0.0414}$

$\boxed{V = -369.7 \text{ volts}}$

$r = 0.0414 \text{ m}$

$= \pi r$

A uniformly charged insulating rod of length = 13.0cm is bent into the shape of a semicircle as shown in the above diagram. The rod has a total charge of Q = -1.70nC. What is the potential a distance r away from all points in the rod?

-369.7	V	☑ Answer the question

Submit

Attempted the problem 0 times.

There have been no attempts to answer the problem

ALL CHARGE ON SURFACE!

a) INSIDE SPHERE (b) $\vec{E} = 0$

V CONST. $= kQ/r_0 = \frac{(9\times10^{9})(2.3\times10^{-9})}{0.56}$

$\boxed{= 36.96 \text{ volts}}$

Problem #6

A conducting sphere has a radius of R = 56.0cm and a total charge of Q = 2.30nC. For a radial distance of r_1 = 26.0cm, calculate (a) the electric potential and (b) the magnitude of the electric field. For a radial distance of r_2 = 81.0cm, calculate (c) the electric potential and (d) the magnitude of the electric field.

(a)	36.96	V	☑ Answer part (a)
(b)	0	V/m $\hat{r}$	☑ Answer part (b)
(c)	25.56	V	☑ Answer part (c)
(d)	31.55	V/m $\hat{r}$	☑ Answer part (d)

c) OUTSIDE SPHERE

$V = \frac{kQ}{r} = \frac{(9\times10^{9})(2.3\times10^{-9})}{0.81}$

$= \boxed{25.56 \text{ V}}$

d) OUTSIDE SPHERE $E = \frac{kQ}{r^2}$

$E = \frac{(9\times10^{9})(2.3\times10^{-9})}{(0.81)^2}$

$\boxed{= 31.55 \text{ V/m}}$

Submit

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)

Problem #7

$V = \sum V_i = k \sum \frac{q_i}{r_i}$

FOR O $V(O) = \frac{k}{r} \sum q_i = \frac{kQ}{r}$

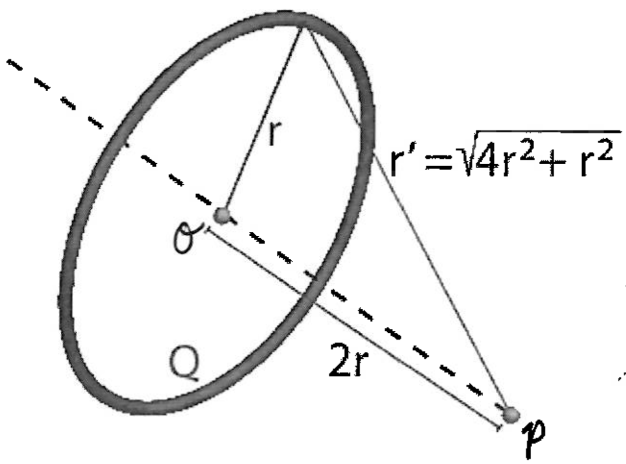
SINCE ALL q_i ARE SAME DISTANCE r FROM O.

$V(O) = \frac{(9\times10^{9})(1.4\times10^{-9})}{0.76} = \boxed{16.6 \text{ VOLTS}}$

BUT @ P. $V(P) = k \sum \frac{q_i}{r_i} = \frac{k}{r'} \sum q = \frac{kQ}{r'}$

w/ $r' = \sqrt{4r^2 + r^2} = \sqrt{5}\, r = \boxed{1.7 \text{ m}}$ SO ⇒

$V(P) = \frac{(9\times10^{9})(1.4\times10^{-9})}{1.7} = \boxed{7.4 \text{ V}}$



A ring of radius r = 76.0cm has a total charge of Q = 1.40nC spread uniformly over its perimeter. Calculate the magnitude of the difference in electric potential between the point at the center of the ring and a point that is a distance of 2r away from the ring and lying on the ring's z-axis.

[9.19] V Answer the question

SO $\Delta V = |V(O) - V(P)|$

$= \boxed{9.19 \text{ VOLTS}}$

Submit

Attempted the problem 0 times.

There have been no attempts to answer the problem

Problem #8

kQ/r_0

=

The electric potential inside a conducting sphere is 185V, and a distance d =

$r = r_0 + 0.24$

24.0cm from the surface of the sphere, the potential is 135V. Calculate (a) the radius of the sphere and (b) the charge on the sphere.

(a) 64.8 cm Answer part (a)

(b) 13.32 nC 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)

SO 1ST SENTENCE IS

$$\frac{KQ}{r_0} = 185$$

2ND SENTENCE IS

$$\frac{KQ}{r_0 + 0.24} = 135$$

TAKE ONE EQUATION & DIVIDE IT BY THE OTHER! KQ'S DROPOUT

$$\frac{r_0 + 0.24}{r_0} = \frac{185}{135}$$

$$1 + \frac{0.24}{r_0} = \frac{185}{135}$$

$$\Rightarrow \boxed{r_0 = 0.648}$$

& SO PLUG THAT BACK INTO FIND Q.

$$\frac{(9\times10^9)Q}{0.648} = 185 \Rightarrow \boxed{Q = 13.32\,nC}$$