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MATRICULATION NUMBER- 19/MHS09/025

DEPARTMENT- DENTISTRY

COLLEGE- MHS

COURSE CODE-PHY102

LEVEL- 100

2.

A. Electric field is a region of space in which an electric charge will experience an electric force.

Electric field intensity is defined as the force per unit charge .

B.

i. $E1= kq1/r^2$

$= 9\times10^9 \times 8\times10^{-6}/0^2$

$= 7200N/C$

$E2= kq2/r^2$

$= 9\times10^9 \times 12\times10^{-6}/4^2$

$= 6750N/C$

$Ep= E1+E2$

$= 7200 + 6750$

$= 13950N/C$

ii.

$E= 13950/2$

$= 6975$

$E= 9\times10^9 \times 6975/r^2$

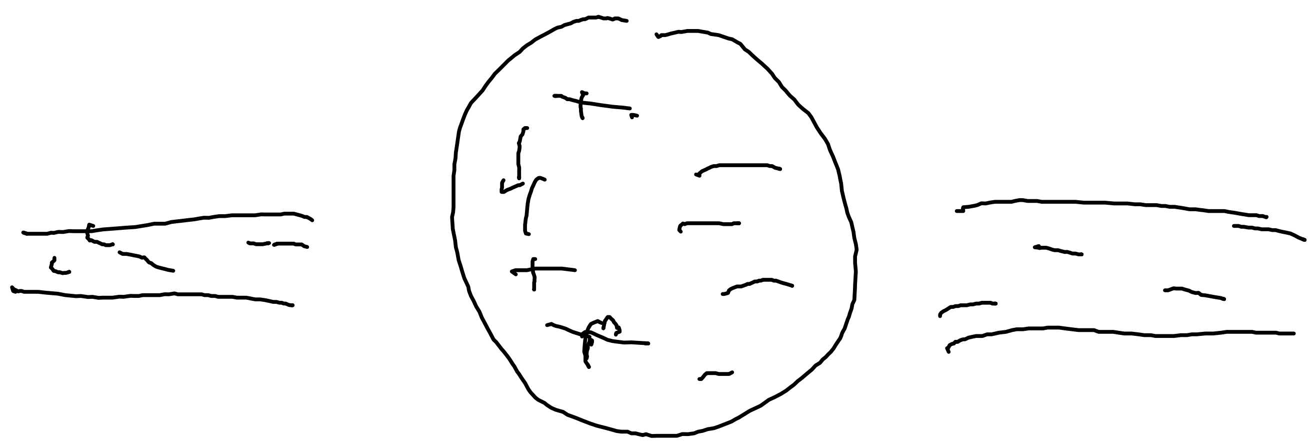
$=6.975\times10^{12}N/C$

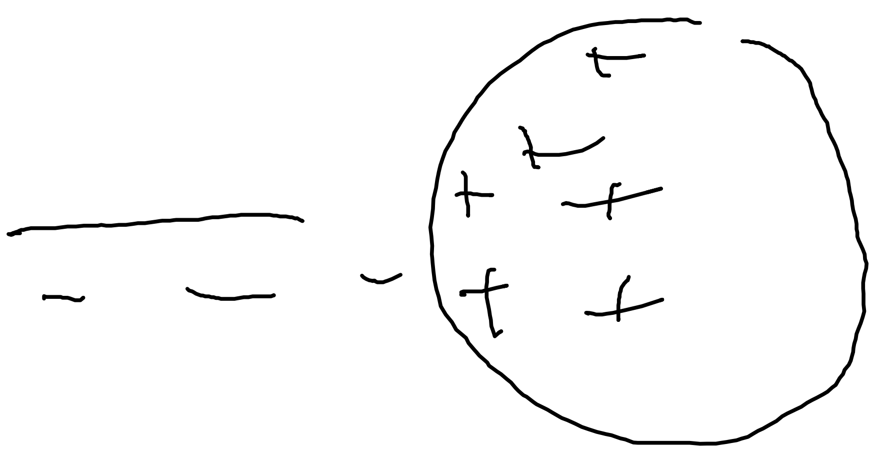
1.

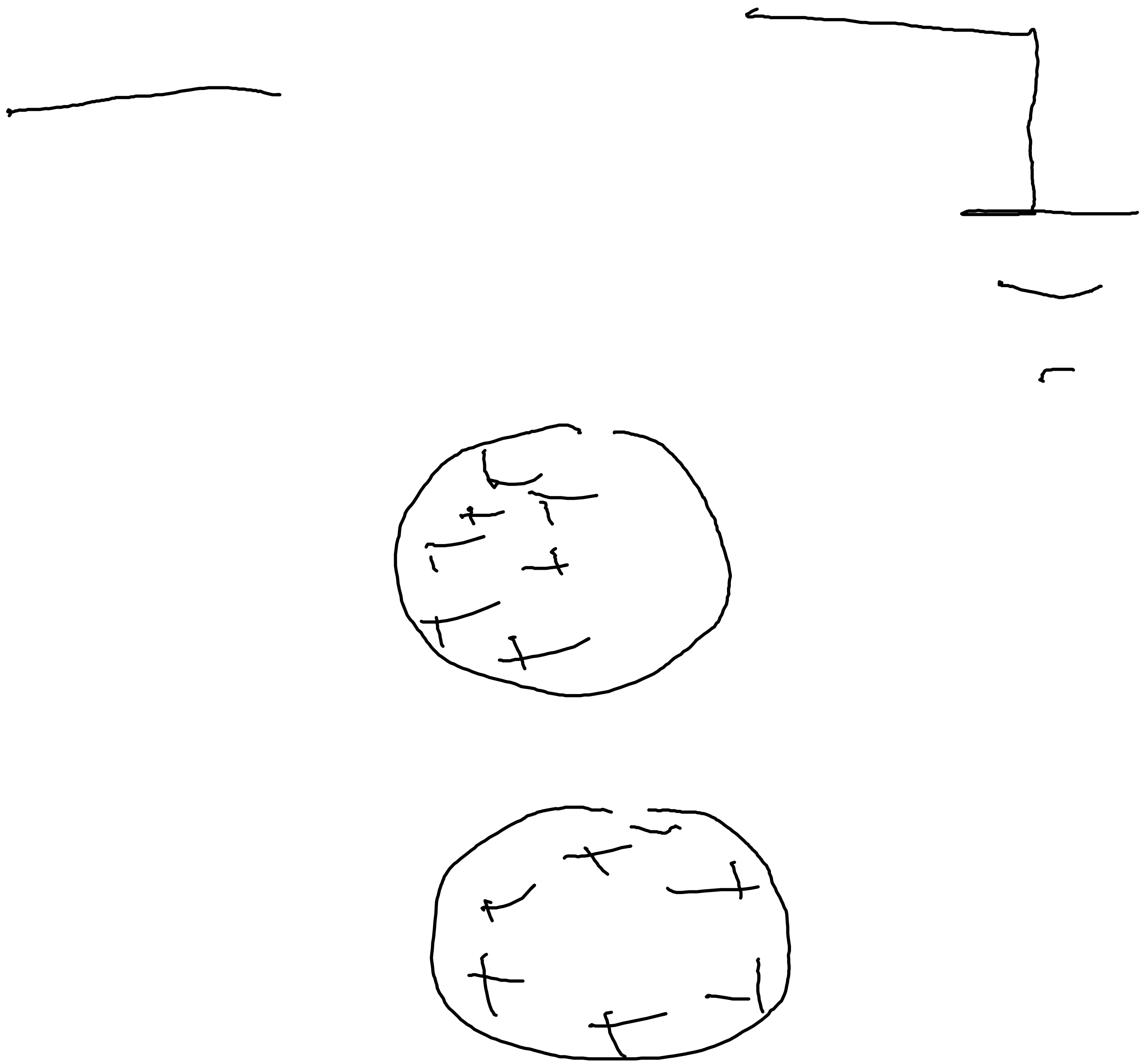
A.

Electric charges can be obtained on object without touching it, by a process called electrostatic induction.

Consider a negatively charged rubber rod brought near a neutral(uncharged) conducting sphere that is insulated so that there is no conducting path to ground as shown below. The repulsive force between the electrons in the rod and those in the sphere causes a redistribution of charges on the sphere so that some electrons move to the side of the sphere farthest away from the rod. The region of the sphere nearest the negatively charged rod has an excess of positive charge because of the migration of electrons away from the location. If as grounded conducting wire is then connected to the sphere, as in the figure below, some of the electrons leave the sphere and travel to the earth. If the wore to the ground is then removed, the conducting sphere is left with an excess of induced positive charge.







M

Finally, when the rubber rod is removed from the vicinity of the sphere, uniformly distributed over the surface of the sphere.

B.

$F = kq1q2/r^2$

$q1+q2=5\times10^{-5}$

$1= 9\times10^9\times q1\times(5\times10^{-5} - q1)$

$4= 450000q-9\times10^9q^2$

$9\times10^9q^2 - 450000q+4=0$

-b+or-$(b^2+4ac)^1/^2/2a$

450000+or-$(-4500+4\times9\times10^9\times4)^1/^2/2(9\times10^9)$.
450000+or- $-379,473.73/1.8\times10^{10}$

$q1=4.61\times10^{-5}C$

$q2=3.92\times10^{-6}C$

C.

$X^2= 1^2+0.5^2$

Square root of both sides

X= 1.12

Ta~~n θ~~= opp/adj

= 1/0.5

= $Tan^{-1}(2)$

$=63.4^o$

5.

A. The Biot-Savart law is based on the following observations for the magnetic field db at a point P associated with a length element do of a wire carrying a steady current

B.

B= ųoI/4pie integral power a subscript-a dlsin(pie-Q)/x^2+y^2 (i)

Sin(pie – Q)= $x/(x^2+y^2)^{1/2}$= $x/(x^2+y^2)^{1/4}$

B= ųoI/4pie integral power a subscript -a $x/(x^2+y^2)(x^2+y^2)$

B= ųoI/4pie integral power a subscript-a dl $x/(x^2+y^2)^{3/2}$

Recall dl=dy

B=ųoI/4pie integral power a subscript -a $x/(x^2+y^2)^{3/2} \times dy$

B= ųoIx/4pie integral power a subscript -a $1/(x^2+y^2)^{3/2} \times dy$. ...(ii)

Using special integral:

Integral $dy/(x^2+y^2)^{3/2} = 1/x^2 \times y/(x^2+y^2)^{1/2}$

Equation(iii) therefore becomes:

B= ųųox/4pie $[y/x^2(x^2+y^2)^{1/2}]$ power a subscript-a.

B= ųoIx/4pie $[2a/x^2(x^2+y^2)^{1/2}]$

B= ųoI/4pie x $[2a/(x^2+a^2)^{1/2}]$

When the length 2a of the conductors is very great in comparison to its distance x from point P, we consider it infinitely long. That is, when a is much larger than x, $(x^2+a^2)^{1/2}$= a, as a to infinity

Therefore: B= ųoI/2pie x

4.

A. Magnetic flux is defined as the strength of magnetic field represented by lines of force.

B.

M= 9×10^{-31}

R= 1.4×10^{-7}

B= 3.5×10^{-1} Weber/meter^2

Cyclotron frequency= angular spee1.w= v/r=qB/m

W=qB/m

= $1.6\times10^{-19}\times3.5\times10^{-1}/9\times10^{-31}$

W= 62222222222.22222T^{-1}

C.

In the question we were given parameters such as:

I. Mass of the electron= 9.11×10^{-31}kg
II. A radius of 1.4×10^{-7}m
III. Magnetic field of 3.5×10^{-1} Weber/meter^2

The question is to find the cyclotron frequency which is equal or the same thing as angular speed. It is called cyclotron frequency because it is a frequency of an accelerator called cyclotron.

Recall that angular speed is W==

Substituting we have

W=== 1.6×10^-10×3.5^10-^{10}

9.11×10^-31

=62222222222.22222T-^{1}

So since cyclotron frequency is equal to angular speed the cyclotron frequency is equal to angular speed = 62222222222.22222T-^{1}, having a unit as 1/T which is equal to the unit of frequency dimensionality