Name: Idaye Tamunonengiofori Peniel

Department: Mechanical Engineering

Matric No: 19/ENG06/027

1(b)

q1 + q2 = 5.0 × 10-5C

F = k =1.0N

q1q1 = (1.0N)

(1.0N)(2.0m)2 8.99×109N.m2C2

= 4.449× 10-10C2

q2 = 5.0 × 10-5 –q1

q1q2 = 4.449 × 10-10

q1 (5.0 × 10-5 –q1) = 4.449 × 10-10

q1-q12) = 4.449 × 10-10

q12 - (5.0 × 10-5)q1 = 4.449 × 10-10 = 0

Using Quadratic Formula,

q1,2 =

q1= 3.84 × 10-5C2; q2= 1.16 × 10-5C2

(1c)

2(a)

Electric field is a region around a charged particle or object within which a force would be exerted on other charged particles or objects.

The electric field intensity is the measure of the strength of an electric field at any point. It is equal to the electric force per unit charge experienced by a test charge which is placed at that point.

3(a)

(i) Per unit length i.e. linear charge density, where q is the charge and is the length over which it is distributed. The SI unit will be Coulomb m ^ {-1}*m*−1.

(ii) Per unit surface area i.e. surface charge density, where, q is the charge and A is the area of the surface. The SI unit is Coulomb m ^ {-2}*m*−2.

(iii) Per unit volume i.e. volume charge density, where q is the charge and V is the volume of distribution. The SI unit is Coulomb m ^ {-3}*m*−3.

Charge density depends on the distribution of electric charge and it can be positive or negative. The charge density will be the measure of electric charge per unit area of a surface, or per unit volume of a body or field.

The charge density describes how much the electric charge is accumulated in a particular field. Mainly, it finds the charge density per unit volume, surface area, and length.

It measures the amount of electric charge per unit measurement of the space. This space may be one, two or three dimensional. Charge density will depend on the position, which can be negative.

(i) Per unit length i.e. linear charge density, where q is the charge and is the length over which it is distributed. The SI unit will be Coulomb (m-1).

(ii) Per unit surface area i.e. surface charge density, where, q is the charge and A is the area of the surface. The SI unit is Coulomb (m-2).

(iii) Per unit volume i.e. volume charge density, where q is the charge and V is the volume of distribution. The SI unit is Coulomb (m-3).

### **Formula for Charge Density**

1. Linear charge density is computed as:

  =

1. Surface charge density is computed as:

=

(3)        Volume charge density is computed as:

=

3(b)

electric potential difference is the difference in electric potential (V) between the final and the initial location when work is done upon a charge to change its potential energy

V =IR

V = voltage

I = Current

R = Resistance

3(C)

Potential is kQ/r  
testing three cases: to the left of Q1, to the right of Q2, and inbetween.  
: to the left (x<0)  
V=k\*10/x-k2/(4+x)  
or 2x=10(4+x)  
x=-40/8=-5m  
: in between  
V=k10/x-2k/(4-x) or  
0=40-x-2x or x=40/3 which is not in between the points.  
: to the right  
V=10k/(x)-2k/((x-4) or  
10x-40=2x  
8x=40 or x=5m

4(a)

(b) An electron with a rest mass of 9.11 x 10 -31kg moves in a circular orbit of radius in a uniform magnetic field of 3.5 x 10 -1 Weber/meter square, perpendicular to the speed with which electron moves. Find the cyclotron frequency of the moving electron.

5(a)

The Biot-Savart Law is an equation that describes the magnetic field created by a current-carrying wire and allows you to calculate its strength at various points. ... If you point your thumb in the direction of the current in a wire, your fingers will curl around that wire in the direction of the magnetic field

5(b)

It's a basic rule of physics (called Faraday's law) that a changing magnetic field produces electricity. So a guitar string will produce electricity only for as long as the magnetic field is changing—in other words, for only as long as the metal string is moving. Once the string stops vibrating, the sound stops

5(b)

The Biot–Savart law is used for computing the resultant magnetic field B at position r in 3D-space generated by a flexible current I (for example due to a wire). A steady (or stationary) current is a continual flow of charges which does not change with time and the charge neither accumulates nor depletes at any point. The law is a physical example of a line integral, being evaluated over the path C in which the electric currents flow (e.g. the wire). The equation in SI units is

B(r) =

where {\displaystyle d{\boldsymbol {\ell }}}dl is a vector along the path C {\displaystyle C}C whose magnitude is the length of the [differential](https://en.wikipedia.org/wiki/Infinitesimal) element of the wire in the direction of [*conventional current*](https://en.wikipedia.org/wiki/Conventional_current).  L{\displaystyle {\boldsymbol {\ell }}} is a point on path {\displaystyle C} C. {\displaystyle \mathbf {r'} =\mathbf {r} -{\boldsymbol {\ell }}}  r1=r-l the full [displacement vector](https://en.wikipedia.org/wiki/Displacement_vector) from the wire element ({\displaystyle d{\boldsymbol {\ell }}}dl) at point {\displaystyle {\boldsymbol {\ell }}}L to the point at which the field is being computed ({\displaystyle \mathbf {r} }r), and μ0 is the [magnetic constant](https://en.wikipedia.org/wiki/Magnetic_constant).

6(a)

It's a basic rule of physics (called Faraday's law) that a changing magnetic field produces electricity. So a guitar string will produce electricity only for as long as the magnetic field is changing—in other words, for only as long as the metal string is moving. Once the string stops vibrating, the sound stops.