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ELECTRICAL ELECTRONICS ENGINEERING
ENGG 221 [BASIC ELECTRONICS]

- 1.) Using the concept of Newton's second law of motion, describe the magnitude and direction of the acceleration of an electron being shot horizontally into a closed space with a uniform field being directed upward.

Answers
The acceleration of a system is directly proportional to and in the same direction as the net external force acting on the system, and inversely proportional to its mass.

Newton's second law states that the vector sum of the force \vec{F} acting on an object is equal to the mass m of that object multiplied by the acceleration a of the object. $\vec{F} = m\vec{a}$

$$F = ma$$

When an electron enters the field, there is a vertical downward force acting on it. This is because electric force acts in the opposite direction to an electric field and the electric field always points upwards.

The magnitude of the force is given by $F = qE$,

where

E - electric field strength

q = charge of the electron

Since no force acts horizontally, the magnitude of the acceleration is given by using Newton's second law $F = ma$

a - acceleration

m - mass

F - Force

q - charge

$$a = F/m = qE/q/m = E/m$$

The direction of ' a ' is downward just like the way force is directed. This obeys Newton's second law; force is directly proportional to the acceleration.

The S.I. unit of force is Newton (N) is the force needed to accelerate

a 1 kg system at the rate of 1 m/s^2 . That is since $F_{\text{net}} = ma$

$$1 \text{ N} = 1 \text{ kg} \cdot \text{m/s}^2$$

2) Describe the electric field, magnetic field and electric current with respect to charge.

Answer

Electric field is defined as the electric force per unit charge. The direction of the field is taken to be the direction of the force it would exert on a positive test charge. The electric field is radially outward from a positive test charge and radially inwards a negative point charge.

Electric field in $\frac{N}{Coulombs}$ or V/m $E = \frac{F}{q}$ Electric Field

$F = E$ electric force in newtons $F = qE$

q Charge in coulombs q_2 charge.

The electric field of a point charge can be obtained from coulomb's law

$$E = F = k \frac{Q_{\text{source}} q}{r^2}$$

The electric field from any number of point charges can be obtained from vector sum of the individual fields. A positive number is taken outwards/field while a negative charge is towards it.

Magnetic field

Magnetic field is defined by the force that a charged particle experiences moving through a field. The magnitude of this force is proportional to the amount of charge q , the speed of the charged particle v and the magnitude of the applied magnetic field. The direction of the force is perpendicular to both the direction of the moving charged particle and the direction of the applied magnetic field. Based on these observations, we define the magnetic field strength B based on the magnetic force $F \rightarrow$ on a charge q moving at velocity $v \rightarrow$ as the cross product of the velocity and magnetic field that is

$$F = qvB \sin \theta$$

F = magnetic force

q = charge of the particle

B = Magnetic field strength

v = velocity at which the charge is moving with

Electric Current

Electric current is a stream of charged particles such as electrons in a wire.

Moving through an electric conductor or space. It is measured as the rate of flow of electric charge past a region. The moving particles are called charge carriers, which may be one of the several types of particles depending on the conductor. In electric circuits the charge carriers are often electrons moving throughout a wire.

common symbol

I

SI unit

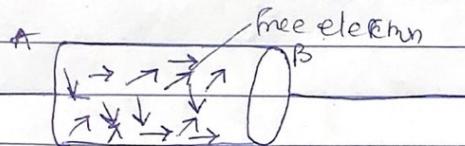
Ampere (A)

Derivation from other
quantities

$$I = \frac{Q}{t}, I = \frac{V}{R}$$

Dimension

I



'metallic wire'

Free electron flowing in a metallic wire